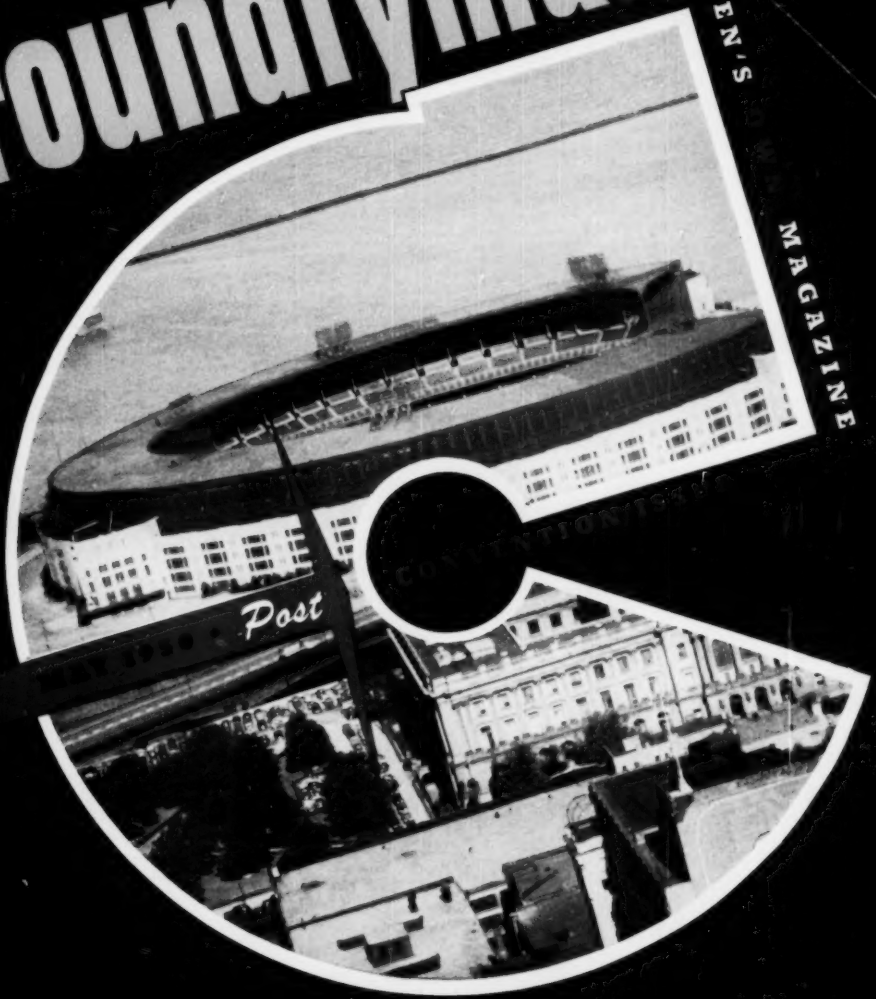
American Foundryman

THE FOUNDRYMEN'S MAGAZINE



FOR A SMOOTH, FAST TURNAROUND

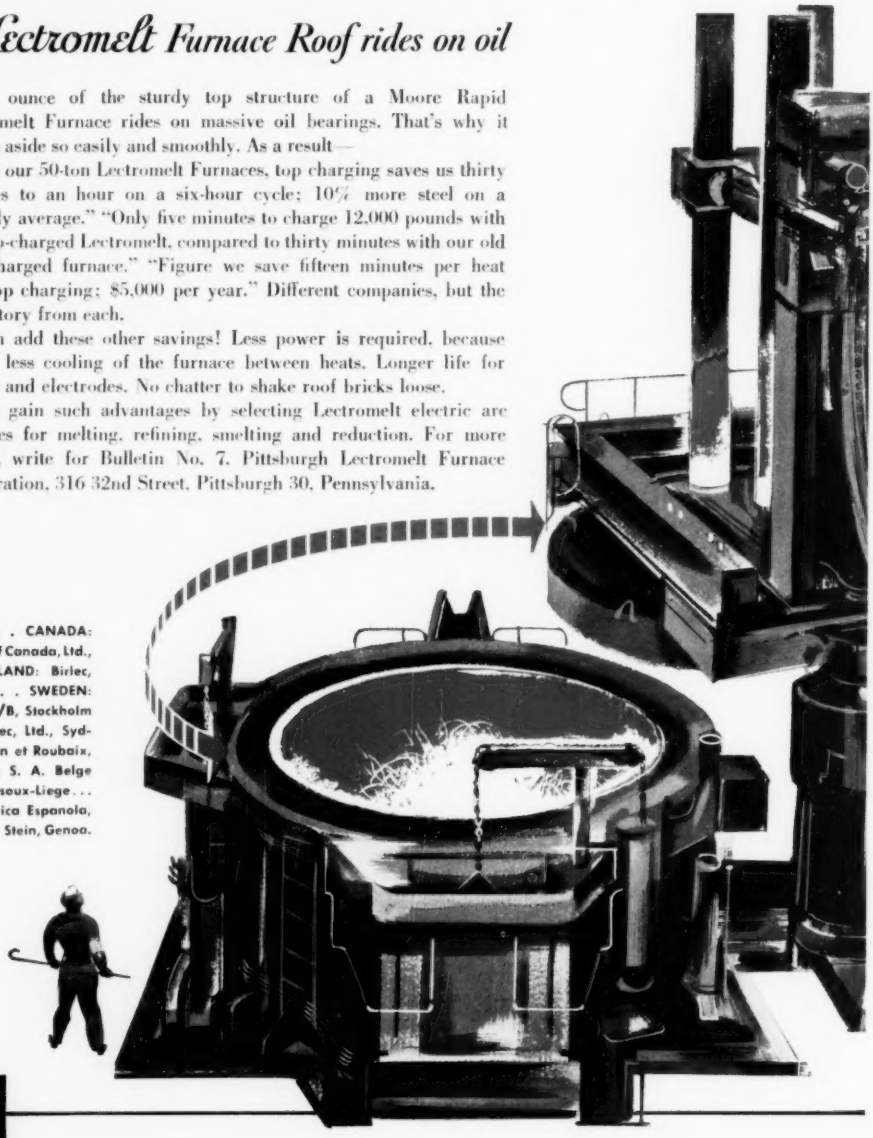
a Lectromelt Furnace Roof rides on oil

Every ounce of the sturdy top structure of a Moore Rapid Lectromelt Furnace rides on massive oil bearings. That's why it swings aside so easily and smoothly. As a result—

"On our 50-ton Lectromelt Furnaces, top charging saves us thirty minutes to an hour on a six-hour cycle; 10% more steel on a monthly average." "Only five minutes to charge 12,000 pounds with our top-charged Lectromelt, compared to thirty minutes with our old door-charged furnace." "Figure we save fifteen minutes per heat with top charging; $5,000 per year." Different companies, but the same story from each.

Then add these other savings! Less power is required, because there's less cooling of the furnace between heats. Longer life for linings and electrodes. No chatter to shake roof bricks loose.

You gain such advantages by selecting Lectromelt electric arc furnaces for melting, refining, smelting and reduction. For more details, write for Bulletin No. 7. Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.



Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . SWEDEN: Birlec Elektkougnar A/B, Stockholm . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bresseux-Liege . . . SPAIN: General Electrica Espanola, Bilboa . . . ITALY: Forni Stein, Genoa.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

SIGNS of the trend...

Here's an 18-second summary on why most foundries use Crown Hill Seacoal Facing for venting molds.

● The high volatile content (see Bureau of Mines figures) of Crown Hill means quick flash. Since the fusion point of the small ash residue is 2980° F., molten iron cannot fuse it, and low sulphur content eliminates hard spots. In short, peeling is easy and cleaning costs *come down.* Try Crown Hill, choice of most foundrymen.

FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.

(Moisture Free)

PROXIMATE ANALYSIS

Volatile Matter (V.C.M.)	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS

Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	6.6%
Sulphur	.7%
Ash	3.7%
	100.0%

Fusion Point of Ash . . . 2980° F

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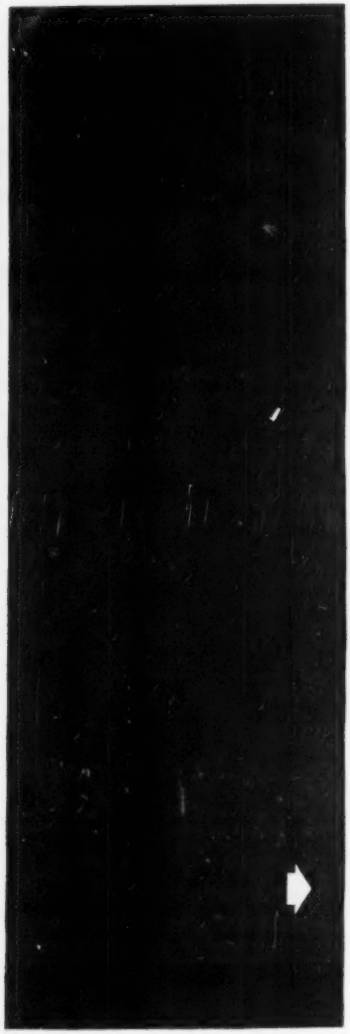

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May, 1950

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CONTENTS

Editorial: Tools to Him That Can Handle Them: E. C. Hoenicke 33
Convention News Story 34
Society Elects New Officers and Directors at Convention 54
Metallurgical Oxygen Speeds Foundry Open Hearth Melting: L. L. Whitney 57
Apprentice Contest Winners Announced 60
Non-Ferrous Foundry Practice: C. A. Robeck 64
Tell Early Plans for 1950-51 Regional Foundry Conferences 70
Install Eighth A.F.S. Student Chapter at Michigan State College 71
Air Conditioning Crane Cabs: R. D. Darragh 72
Modern Foundry Methods: Sand and Metal Handling 74
Further Results of Belgian Nodular Cast Iron Research: A. L. DeSy 75
Students Construct Laboratory Skip Hoist 84
Mechanized Sand Conditioning and Distributing System at Ohio State: J. W. Anibal 85
Operation Tulsa — Joint Education Program Trains Foundrymen 87
Malleable Iron Annealability: Milton Tilley 88
Chicago's Lane Tech High School Benefits From Chapter-Teacher Cooperation: Howard W. Smith 90
Foundry Exhibit Steals Show at University of Illinois Open House 94
Who's Who 95
New A.F.S. Members 96
Chapter Officers and Directors 99
Foundry Personalities 100
Chapter Activities News 102
Chapter Meeting Notices 104
New Foundry Products 116
Foundry Firm Facts 118
Foundry Literature 120
Abstracts of Foundry Literature 129
A.F.S. Employment Service 135
Advertisers' Index 136
Buyers' Guide 137

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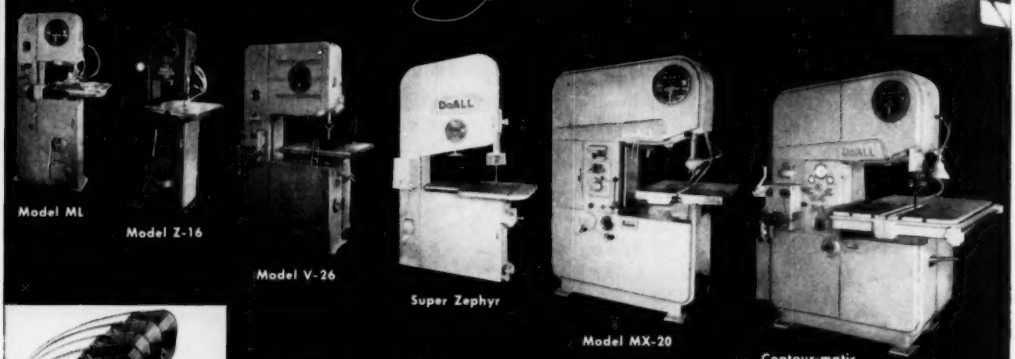

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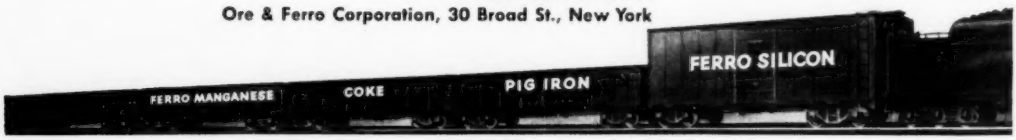

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EXCLUSIVE TWO-PIECE CONSTRUCTION . . . THICKER AND WIDER BEARING BAR
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BS&B's extra bearing thickness delivers far longer service . . . and it can be machined at least four times to lengthen its life! Yes, since foundry men design and build BS&B Flasks, you can expect BS&B Flasks to be superior. Lighter weight, easier to handle, sharp precision, rugged construction, long production life . . . that's why you should employ BS&B.

Watch for current BS&B advertising to convince your casting customers of the quality of your work. In STEEL, IRON AGE, PURCHASING . . . another BS&B service!

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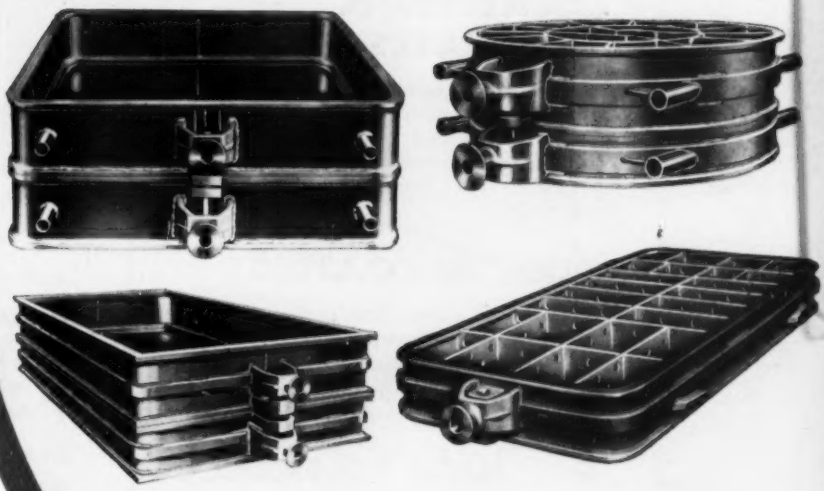

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FEATHEREDGE FUSION RINGS

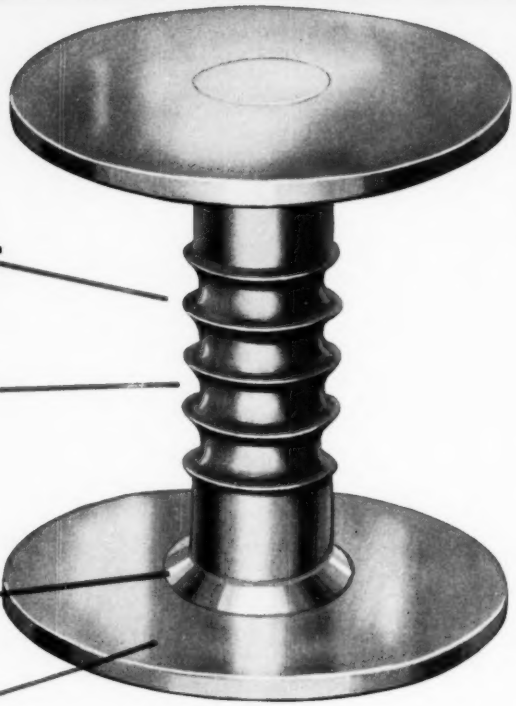
Knife-like multiple Rings heat instantaneously to fusion temperatures—burning in and eliminating leakers.

COMPLETE CONTACT RADIUS GROOVES

Molten metal lays up solidly against the rounded bases of the radius grooves. Greater chaplet area contact results in maximum fusion. No sharp threads to trap gases or weaken stem strength.

COUNTERSUNK SHOULDERS

Heavy tapered shoulders provide solid support to plates—allow full contact with molten metal. No sharp angles to create voids usually formed under heads of ordinary chaplets.



Patent Pending

PURE TIN COATING*

Not only the surest known protection against rust, but actually an aid to fusion. Tin readily alloys with iron or steel lowering melting point, thus improving fusion.

PRECISION TOLERANCES

Held to plus or minus .002 on most sizes, Fanner reputation for accuracy is unequalled.

There is Something New in Chaplets that Brings Your Foundry

1. **Assured Core Support**
2. **Maximum Fusion**
3. **Freedom From Leakers**
4. **Accurate Wall Thicknesses**

The FANNER MFG. CO. *Fanner Chaplets . . .*

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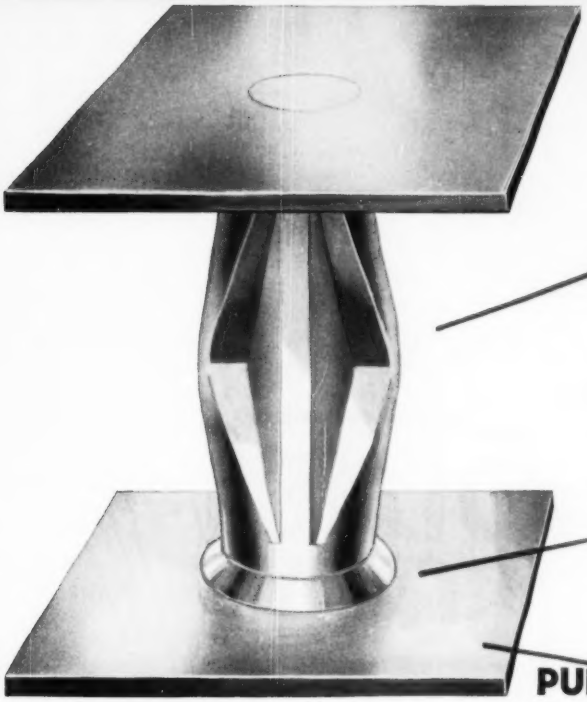
The Improved SUPERSTEM

Famous for Years as Sturdiest of All Chaplets



BROAD ANGLE SUPER STEM

To provide greater fusion area, to create a stronger stem and to promote better knitting.

New COUNTERSUNK SHOULDERS

To permit molten metal to lay up in direct contact with all of the shoulder, eliminating voids.

PURE TIN COATING*

Not only the surest protection against rust, but actually an aid to fusion. Tin readily alloys with iron and steel lowering melting point, thus improving fusion.

PRECISION TOLERANCES

Held to plus or minus .002 on most sizes, Fanner reputation for accuracy is unequalled.

For 56 years Fanner Chaplets have been the standard of excellence in the foundry industry. In an effort to produce an even better chaplet, The Fanner Manufacturing Company commissioned the Battelle Memorial Institute, Columbus, Ohio, to conduct *exhaustive studies of chaplet design*. Based on these studies, supplemented by field tests in leading foundries, Fanner Manufacturing Company has developed the new Groovestem chaplet and has redesigned the Famous Superstem, further insuring the maximum in core support and completeness of fusion.

* —*Also available in Pure Copper.*

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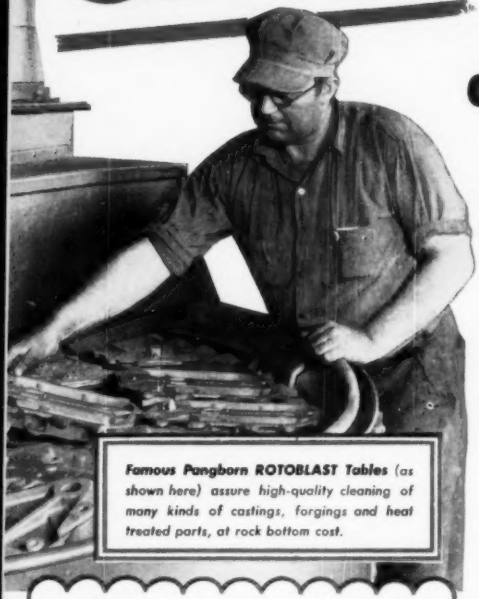
on BLAST CLEANING with PANGBORN ROTOBLAST*



Famous Pangborn ROTOBLAST Tables (as shown here) assure high-quality cleaning of many kinds of castings, forgings and heat treated parts, at rock bottom cost.

BY THE WEEK: One foundry, with ROTOBLAST, slashes *$211.56* every week off their blast cleaning bill. An additional saving in this case is *lower breakage losses*—important in any foundry producing intricate and fragile castings.

BY THE MONTH: One more foundry credits ROTOBLAST with saving $423.30 *each month* on blast cleaning. To prove that blast cleaning goes faster with ROTOBLAST, castings are now cleaned in 1/3 the time it used to take!

BY THE YEAR: $10,160 saved on labor alone each year—that's the story from a large ROTOBLAST-equipped foundry. But there are still more savings: five old-fashioned machines with bothersome dust have been completely eliminated—important for a foundry where space is at a premium!

Find out how much you can save! If you're hampered by old-fashioned blast cleaning methods, you can *save money* with ROTOBLAST. There's a modern, economical, efficient ROTOBLAST *Barrel, Room, Table* or *Table-Room* especially designed to solve every blast cleaning problem. Let Pangborn engineers show what ROTOBLAST can do for you. Write today for Bulletin 214 to PANGBORN CORPORATION, 1408 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

ROTOBLAST makes cash savings possible these five different ways:

SAVES LABOR: *One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.*

SAVES SPACE: *In many cases, one ROTOBLAST machine replaces five or more old-fashioned machines, requires less space.*

SAVES TIME: *Cases on record prove ROTOBLAST can cut cleaning time up to 95.8% compared to older methods.*

SAVES POWER: *Modern ROTOBLAST uses but 15-20 h.p. compared to old-fashioned equipment requiring 120 h.p. for same job.*

SAVES TOOLS: *On work cleaned with ROTOBLAST, cutting tools last up to 3 times longer because no scale is left to dull edges.*

SAVINGS mean PROFITS

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Over 32 Years OF SUCCESS in CASTING IMPROVEMENT

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LEADING FOUNDRIES

SOUNDER CASTINGS. *Reduced Rejects*

Increased Profit

WITH METAL CLEANSED BY FAMOUS CORNELL FLUX

Famous

CORNELL CUPOLA FLUX

IN SCORED BRICK FORM

When you use cupola flux in other forms, the cost of labor—digging out of container, weighing, measuring, etc.—far outweighs the cost of material.

Therefore, there is a "double barrel" advantage in using Famous Cornell Iron Cupola Flux—the time-proven metal cleanser. The initial cost is low, and it takes but a few seconds of labor to flux a charge of iron.

Famous Cornell Cupola Flux removes impurities from molten iron, makes it hotter and more fluid, reduces sulphur and makes slag more fluid.

You pour castings that are cleaner and with big reduction of chilled sides, hollow centers, hard spots, etc. Machining is easier and smoother. The scrap pile of rejects is practically nil.

Famous Cornell Cupola Flux reduces cupola maintenance. Cupolas are cleaner. Drops are cleaner, and there is less bridging over. A glazed or vitrified surface formed on cupola lining (brick or stone) reduces erosion and repairs.

MALLEABLE FOUNDRIES, TOO, ARE GIVING THEIR CASTINGS A BETTER START. There is a rapid trend towards the use of Famous Cornell Cupola Flux in malleable foundries with cupola operation.

Write for Bulletin No. 46-B

PRE-MEASURED SCORED BRICK FORM takes but a few seconds to use. You simply lift Famous Cornell Cupola Flux from its container and toss it into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

Famous CORNELL
BRASS FLUX

CLEANSES MOLTEN BRASS, even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

Famous CORNELL
ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

The CLEVELAND FLUX *Company*

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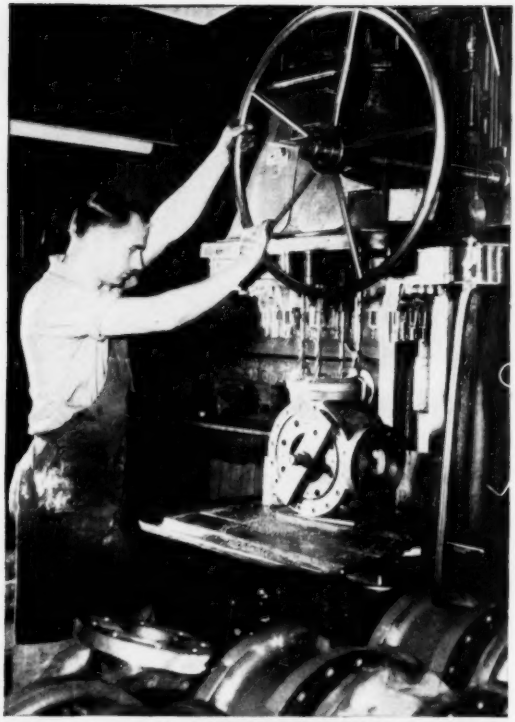
Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

Improving Machinability of GRAY IRON CASTINGS



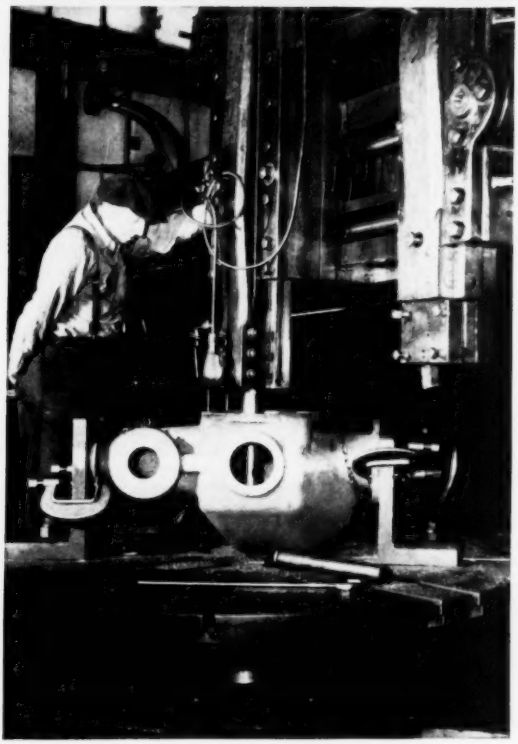
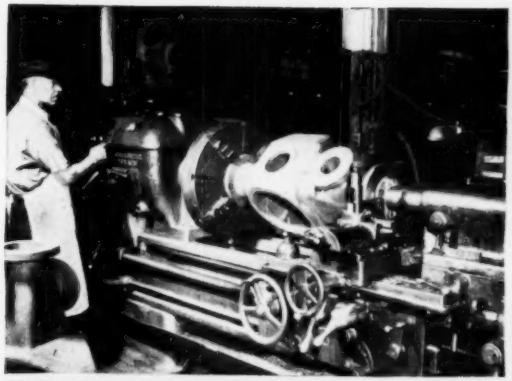
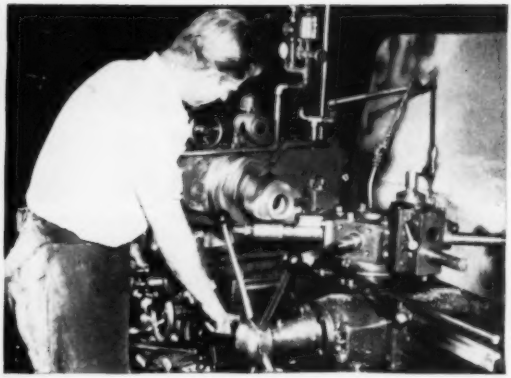


Photo Credit: Photos showing machining of castings, which have been treated with FERROCARBO Briquettes, are by the courtesy of the Rockwell Manufacturing Company, Pittsburgh, Pa. Castings were produced at Monnessen Foundry, a division of Rockwell.





3 IMPORTANT ADVANTAGES

to castings poured from iron which has been deoxidized with FERROCARBO silicon carbide Briquettes are:

1. Reduced machining time
2. Lower tool costs
3. Fewer rejected castings

The net result is realized in lower machining costs and increased profits. Complete detailed information on FERROCARBO Briquettes is easily obtainable from our metallurgical staff.

FERROCARBO Briquettes

BY CARBORUNDUM

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THE CARBORUNDUM COMPANY, Bonded Products and Abrasive Grain Division, Niagara Falls, New York

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BAKE CORES AT LOWER COST
than any other known method

COLEMAN OVENS, because of their exclusive features, produce at the lowest cost, since they—

...***use*** the handling method that gives you the greatest savings in labor!

...***obtain*** the greatest savings from the most economical fuel available!

...***permit*** you to use the most satisfactory binder for your work!

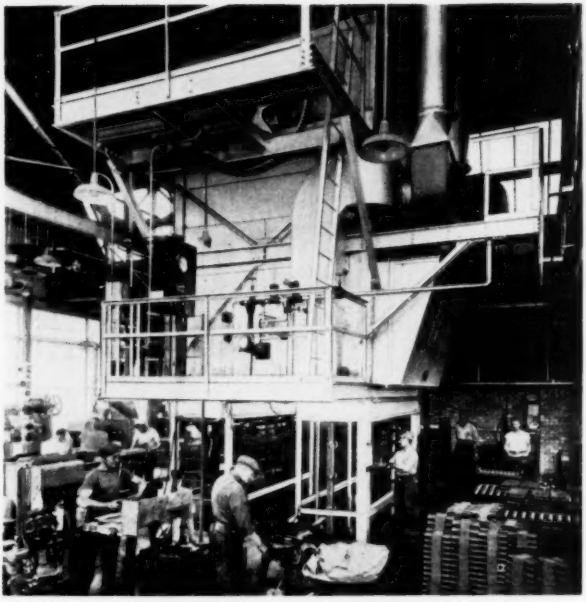
...***utilize*** your available space to the greatest advantage!

...***assure*** perfect baking and drying, eliminate rejects and makeovers.

...***keep*** maintenance cost and time down to a minimum.

COLEMAN OVENS back up these statements with experience gained from over 10,000 installations. No other method of baking cores can match these results...no other core-baking system can meet this record!

For full information about Coleman Ovens write for Bulletin 48 today!



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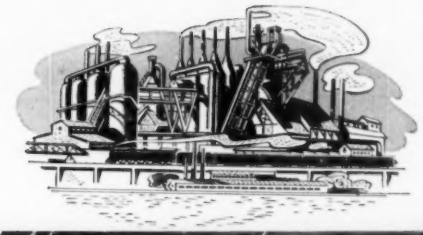

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Losses due to underground corrosion *on pipe lines alone* are estimated at $600,000,000 annually. Protect *your* buried or submerged metal structures, positively and economically, by installing "National" ground anodes.

Regardless of seasonal changes in soil resistance—regardless of whether the soil is wet or dry—"National" ground anodes afford perfect protection against corrosion. They operate with a controllable electric circuit. In dry periods, simply raise the voltage. In wet periods, lower it.

"National" ground anodes have been used for more than 15 years. They outlast any other material. You don't have to dig them up every few years. For highest efficiency, pack "National" graphite backfill material around each anode in the bed.

For complete details, write to Dept. AF

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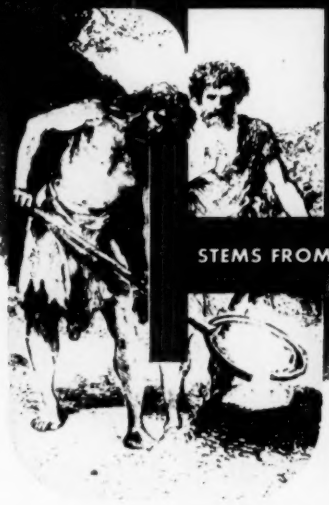
This history of foundry practice, from the days of prehistoric development of metal to modern castings production, brings into sharp focus the fact confirmed by scientific history . . . *progress can be only as swift as research and equipment permit.*

It is the story of man's achievements, through his use of metal, which have contributed so essentially to modern civilization.

Profusely illustrated, this clothbound, 250-page book enables the modern foundryman to glean a deeper appreciation of the field in which he operates. A combination of fact and romance, "*Development of the Metal Castings Industry*" dramatizes the progress of foundry practice . . . a craft as old as mankind . . . an industry that constantly attunes itself to the needs of modern living.



STEMS FROM AN APPRECIATION OF HISTORICAL BACKGROUND

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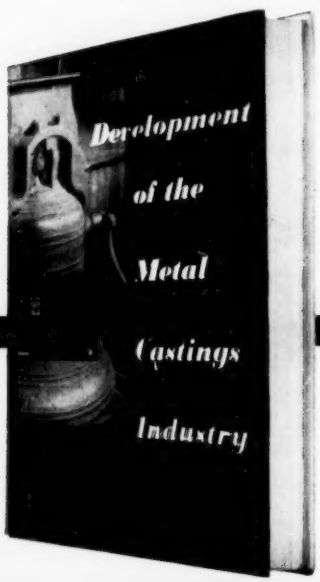

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Lynchburg foundry

mexacote

Lynchburg worker spraying green resin core for clutch housing with a 15° Mexacote solution. Green resin core for transmission is waiting to be sprayed. Baked cores may be dipped for Mexacote treatment.

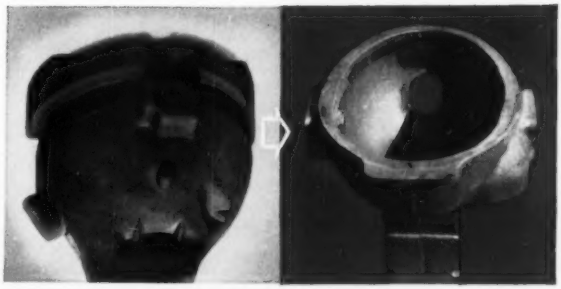
Mexacote-sprayed green resin core for clutch housing is placed in the oven for drying. Some cores are first baked and then given a 40° Baume' coating of Mexacote.

THE UNITED STATES GRAPHITE COMPANY

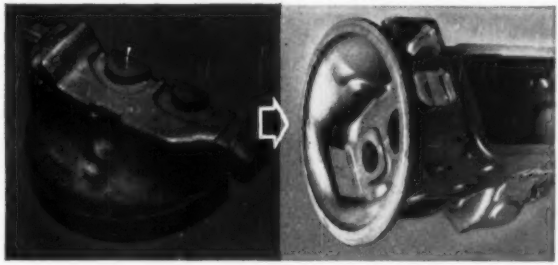
sprays cores with for finer casting finish

To find a product that would produce a high surface hardness on their cores and give a better casting finish, the Lynchburg Foundry Company tested many different products. After exhaustive tests on a wide variety of cores they found that MEXACOTE would do exactly what they wanted it to do. Say Lynchburg engineers: "Now we spray all cores—where spraying is possible—with a 15° Baume' solution of MEXACOTE and the results have been highly satisfactory."

When you want a better casting finish, spray or dip molds and cores with MEXACOTE. It quickly mixes with water and thins to a spraying consistency. MEXACOTE forms a firm coating that will not crack, shrink, scab, peel or buckle under heat, and can be dried by torch, lamp, or oven. A solution of 20° Baume' is usually recommended for spraying, 35° for dipping. MEXACOTE holds true core dimensions, does not run or build up—penetrates sand to prevent burning in. Write for special MEXACOTE bulletin.



From core to casting. The picture at left shows one part of the core assembly for clutch housing after having been sprayed green with Mexacote and baked. At right is the casting. Note fine finish that will require minimum finishing.



At left, resin cores for part of truck transmission case are sprayed green with Mexacote. At right is the transmission case after casting. Note absence of veining of cored surfaces.

mexacote

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ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Extra-Low-Carbon STAINLESS STEEL

New Type Chromium-Nickel Steels Have Added Corrosion Resistance

New and improved austenitic stainless steels of the 18-8 type have been developed which have superior corrosion resistance after being exposed to heat. These steels, known as extra-low-carbon stainless steels, were designed especially for use in welded and stress-relieved equipment that is exposed to more severe corrosive conditions than are normally encountered by other types of straight 18-8 stainless steel.

Under severe corrosive conditions, intergranular attack may occur in the higher carbon unstabilized grades of austenitic stainless steels that have been subjected to the temperature range of 800 to 1600 deg. F. during welding or hot forming operations. It is generally agreed that this type of corrosion is caused by complex carbides that are formed at the grain boundaries of the stainless steel during heating.

The effect of heat is rarely harmful in the ordinary fabrication of stainless steel for most applications, such as in architecture, the food and dairy industries, in hospitals, and in the home. However, in the chemical and other allied industries, where stainless steel is used in the handling of very corrosive chemicals, these new extra-low-carbon stainless steels should most certainly find wide use.

Fig. 1 Left: Carbide precipitation at the grain boundaries of an 18-8 stainless steel, containing 0.059 per cent carbon, after being held at 1200 deg. F. for 1 hour. Right: Absence of carbide precipitation in 18-8 stainless steel of 0.03 maximum carbon content, after being held at 1200 deg. F. for the same length of time.

In general, there are three ways in which the precipitation of carbides can be controlled in stainless steel:

1. Heat-treating so that the carbides present are dissolved.
2. Alloying with an element, such as columbium or titanium, that will tie up the carbon in the form of a harmless carbide.
3. Decreasing the carbon content of the steel.

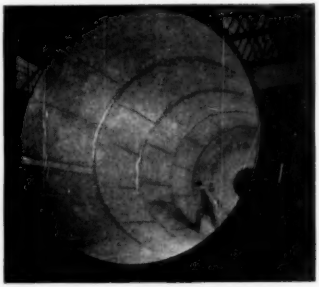

Fig. 2. The new extra-low-carbon stainless steels are especially suited for large types of process equipment, such as this fractionating tower. They require no heat-treatment after welding.

Heat-Treatment After Welding

Before the development of extra-low-carbon stainless steel, or of the "stabilized grades", one means for preventing intergranular corrosion was to heat-treat stainless steel that had been subjected to the dangerous temperature range, so that the precipitated chromium-carbides would go back into solid solution. It was found that when a welded part was heated to temperatures of 1950 to 2000 deg. F., and then cooled rapidly, most of the carbides were retained in solid solution. This extra heat-treatment is sometimes impractical, however, because of the design or massive size of some types of welded equipment.

Use of Columbium and Titanium to "Fix" Carbon

As the result of a search for a method of producing stainless steels that would be immune to intergranular corrosion without heat-treatment, the columbium- and titanium-bearing stainless steels were developed. These elements form carbides more readily than chromium. It was found that columbium, when present in a 10 to 1 ratio to carbon, completely "fixes" the carbon and renders it harmless in stainless steel. A similar effect can be accomplished by alloying with about five times as much titanium as carbon. Steels thus alloyed with columbium or titanium are known as "stabilized grades."

Decreasing Carbon Content

The most recent development in preventing intergranular corrosion has been the extra-low-carbon stainless steels. To be substantially harmless in stainless steel for as-welded or welded and stress relieved chemical equipment operating at temperatures under 700 deg. F., carbon must not be present in quantities over 0.03 per cent.

In 1937, ferrochrome with 0.03 per cent maximum carbon was first produced for the steel industry by ELECTROMET. This product has made it possible to produce very-low-carbon stainless steels—steels that are completely immune to intergranular corrosion when welded or subjected to a stress-relieving heat-treatment.

Metallurgical Service Available

If you use welded stainless steel equipment, it will pay you to investigate the advantages of using extra-low-carbon steels. If you produce stainless steel, our metallurgists will be glad to give you technical assistance in the use of ferrochrome of 0.03 per cent maximum carbon. For further information, write to the nearest ELECTROMET office.

For a more detailed account of the properties of extra-low-carbon stainless steel, write for a free copy of the technical paper, "Resistance to Sensitization of Austenitic Chromium-Nickel Steels of 0.03% Max. Carbon Content".

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There is no "just as good" substitute for any DELTA Core and Mold Wash just as there is no substitute for DELTA'S scientific laboratory control of production which safeguards the quality and uniformity of all DELTA Foundry Products. DELTA Research laboratories developed, and pioneered the use of, Plastic-type Core and Mold Washes . . . and still leads the field in the development of new products for improved foundry practices.

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a. Delta Core and Mold Washes "Anchor" themselves by penetrating from 10 to 12 grains deep into the sand. This bond between the wash and the sand . . . a distinctive DELTA characteristic . . . produces an expansion-resisting coating essential to the production of finer finished castings.

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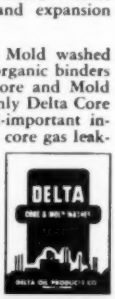
c. No gas leakage through Delta Core and Mold washed surfaces. Gases produced by decomposition of organic binders in the core sand cannot leak through Delta Core and Mold washed surfaces to contact the molten metal. Only Delta Core and Mold Washes provide this unique and all-important insurance against defective castings resulting from core gas leakage. DELTA Core and Mold Washes insure more perfect castings with finer finished surfaces.



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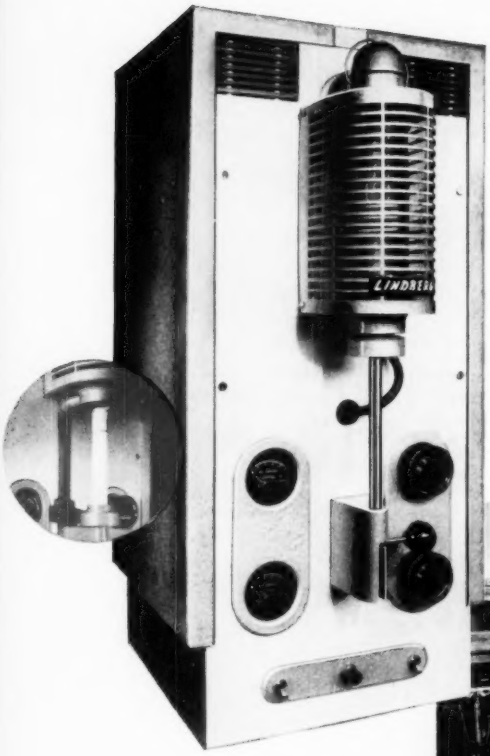

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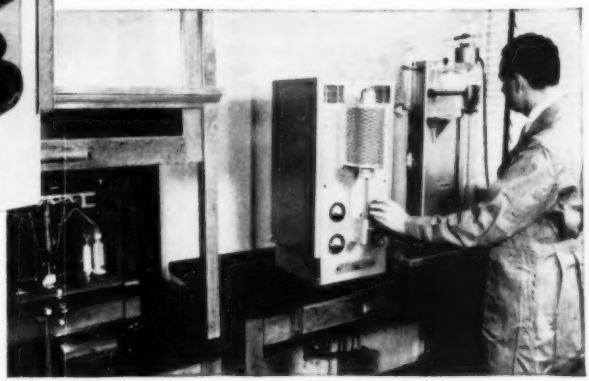

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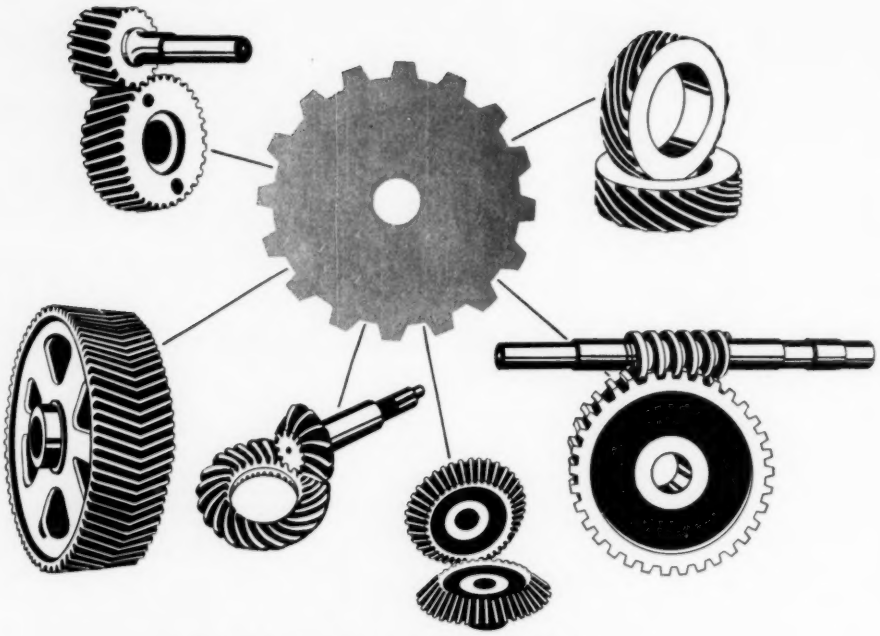

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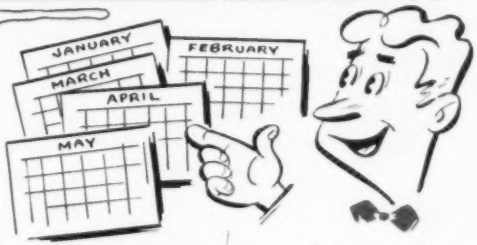
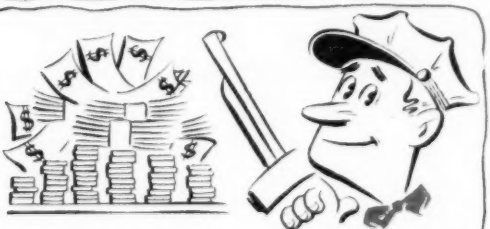
* Results of Malleabrasive test conducted by Lynchburg Foundry Co. of Lynchburg, Va., as reported by The Globe Steel Abrasive Co.



To get the facts on Malleabrasive, Lynchburg Foundry set aside 16 weeks for comparative tests to check cleaning costs before and after using Malleabrasive.

The results were amazing! Lynchburg's impartial tests proved 100 lbs. of Malleabrasive does the work of 230 lbs. of ordinary shot or grit . . . an actual saving of 56.7% hourly!

Further checks on cleaning costs showed Malleabrasive saved $7.38 out of every $10.00 Lynchburg formerly spent for replacement parts. But that's not all . . .



After all test results were in, Lynchburg Foundry found the switch to Malleabrasive means an actual cash saving of $2,995.00 a year—all clear profit.

TEST MALLEABRASIVE YOURSELF!

If you want to save money on blast cleaning, take advantage of this offer! We'll send you all data needed to run a comparative test *just like Lynchburg*'s right in your own cleaning room! Remember, Malleabrasive is *guaranteed* to outperform ordinary shot and grit when comparative tests are properly run. Malleabrasive is more than "heat treated" or "annealed," Malleabrasive is a radically new abrasive. But find out for yourself. Write for TEST INFORMATION to: THE GLOBE STEEL ABRASIVE CO., Mansfield, Ohio.

†U.S. Patent #2184926
(other patents pending)

Save on blast cleaning with

PATENTED†
Malleabrasive®

THE GLOBE STEEL ABRASIVE CO., MANSFIELD, OHIO

· MANUFACTURERS OF METAL ABRASIVES SINCE 1907 ·

insure uniformity and strength!

Controlled uniformity and high bonding strength of core oils contribute to efficiency in performance and economy in castings operations.

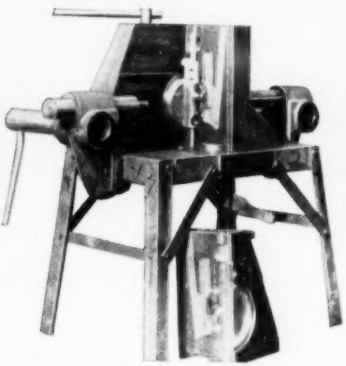
Foundrymen have found that Velsicol core oils possess these essential properties: *clean workability, high bonding strength, to low gas evolution, accelerated baking properties, and rapid* core *collapsibility.* Rigid laboratory control insures • product uniformity.

Velsicol core oils can be used for iron, steel, and non ferrous metal castings. Samples and technical information furnished on request.

Your own tests will convince you that Velsicol core oils can improve your casting production.

VELSICOL CORPORATION

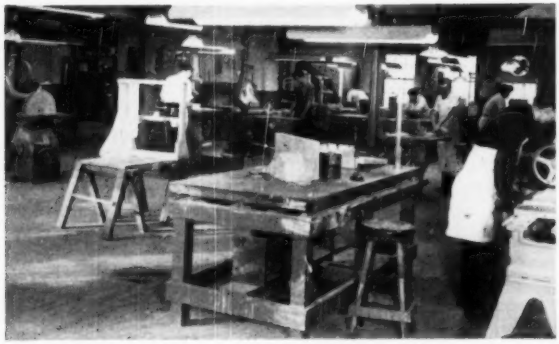
330 EAST GRAND AVENUE, CHICAGO, ILLINOIS • REPRESENTATIVES IN PRINCIPAL CITIES



Manually Operated Permanent Mold
Built by "Master" Craftsmen

Patterns and Permanent Molds Planned

. . FOR LOWER CASTING COSTS . .



The "Master" Wood Shop

"Master" craftsmen take great pride in their ability to furnish the exact mold or pattern to solve specific casting problems. A pride backed by a long record of achievement in lowering production costs to a minimum. Their highly specialized experience on all types of permanent molds, wood and metal patterns can be helpful to you. Why not send your blueprints or sample casting for a quotation? No obligation.

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF PERMANENT MOLDS — PNEUMATIC DRAW TABLES
WOOD AND METAL PATTERNS — ACCURATE SCALE MODELS

MASTER PATTERN COMPANY

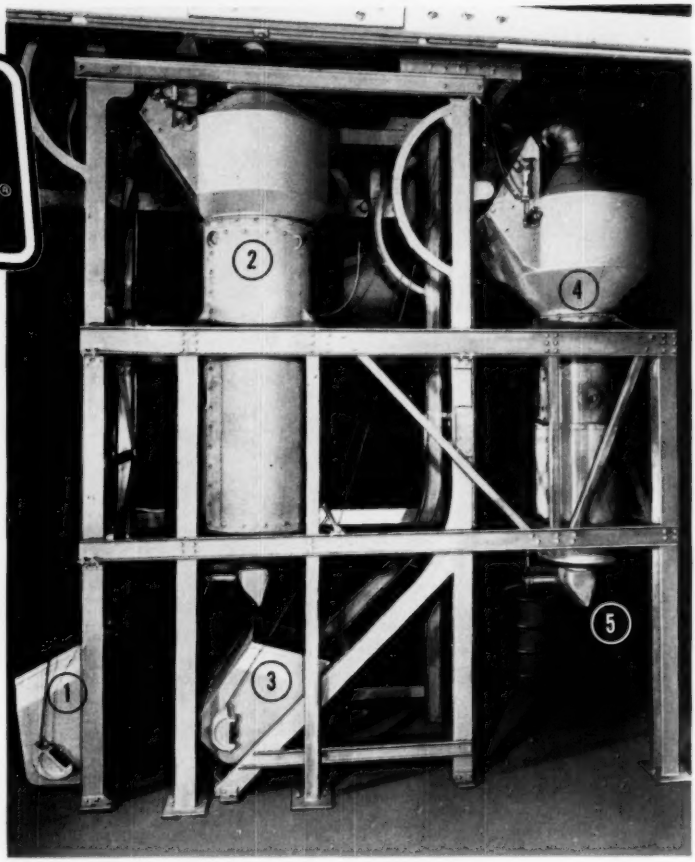
1315 MAIN AVENUE — CLEVELAND 13, OHIO

The NATIONAL SAND DECARBONIZER®

. . . the Compact LOW COST Core Sand Recovery System *that will pay for itself in a short time*

• The new National Sand Decarbonizer has been developed over a ten year period by National Engineering Company. It represents the results of thousands of tests to obtain the lowest priced unit capable of saving the foundryman many times its original cost. It has been proved that, dependent on the cost of new sand and the volume available, the average foundry will be able to save the cost of this equipment in a little over a year and in some cases less. This does not include secondary benefits such as recovery of tramp iron, more uniform sand, self sufficient operation and many other benefits.

For full details, send for a copy of the new Decarbonizer Bulletin 504.



HERE'S HOW IT WORKS . . . Used sand is charged into bucket loader **(1)** which starts automatic cycle by dumping sand into reaction chamber **(2)**. Air at approximately 1700°F. is introduced into the chamber, causing sand to "boil", allowing intimate contact between sand and heated air. Carbonaceous materials are burned off, and scrubbing action also assists in removal of waste. After approximately 12 minutes, discharge valve at the bottom of the reaction chamber opens, and sand drops into the waiting bucket loader **(3)**. This loader again automatically elevates the sand, now at approximately 1000°F., to the cooling chamber **(4)** in which cooling air is forced down through a central pipe, permeating the sand, giving maximum cooling effect and dry scrubbing action. After a cooling cycle of 12 minutes the clear processed sand is discharged **(5)** ready to be reused by the foundry.

SIMPSON Intensive MIXERS

NATIONAL *Engineering Company*

600 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

TOOLS

to him that can handle them

NEW TOOLS for the foundry industry are as necessary as new techniques and appropriate training to keep castings in the important, utilitarian position they have held since prehistoric days. Exceeding expectations, the 54th A.F.S. Foundry Congress and Show continued to help maintain this position by supplying a show case for display of the latest in foundry equipment, supplies, and services in an atmosphere of foundry technology provided by a well-balanced program of technical papers, round table luncheons, and shop course meetings.

Living up to advance reports that it would be the most complete and instructive display of foundry equipment ever staged by the foundry industry and its technical society—the American Foundrymen's Society—this year's exhibit brought innovations in tools, materials, and services that kept crowds of interested foundrymen moving about the five exhibit halls from the show's opening until the end.

Outstanding this year was the obvious trend in equipment toward greater utility and refinement of design. More and more foundry equipment is being engineered to meet specific needs and to withstand better the rigors of foundry use. Today foundrymen have at their disposal tools of a quality approaching machine tools.

This means that foundry equipment geared to high production can be depended upon not only to do the job expected of it but also to do the job efficiently and continuously. Unbroken service becomes more important than the initial cost of the equipment on many production units when the overall cost of down-time . . . wages . . . overhead . . . lost profits on castings not produced . . . is considered. Foundry equipment manufacturers to an increasing extent are meeting the needs of the foundryman by providing him with the facilities for day-after-day one-shift, two-shift, or round-the-clock performance. Dependability and precision are being designed and built into foundry equipment more and more. This is evident in current models of old-line equipment and in the new developments of the past year displayed at the Show.

New foundry tools seen for the first time at an A.F.S. Foundry Congress included equipment for analysis and control of foundry processes, for materials handling, for molding and coremaking, for sand and castings reclamation, for sand mixing, for pouring, for lining of furnaces, and for cupola stack emission control. On display, in addition to today's versions of well-known core blowers, were bench and larger models of new design and construction. Expendable coreboxes for use with any blower were shown. A new production-scale sand mixer with an unorthodox agitator and a laboratory model of simple construction appeared at the Show.

New departure in mold making was demonstrated by a mold blower which produced green sand molds ready for pouring. Another molding machine, produced in England, featured hydraulic turnover and push-button operation while an American design available in jolt or jolt-squeeze mechanically handled the mold during all operations.

Most unusual pieces of equipment shown were a thermal core sand reclaimer and a pneumatic system for transporting sand mixtures.

All this equipment, typical of that seen throughout the Show, was planned and constructed in the best machine tool tradition.

The foundry industry looks forward to the next A.F.S. Foundry Show. Meanwhile, the producers of foundry equipment are truly providing, in Thomas Carlyle's words, "Tools to him that can handle them."

EDWARD C. HOENICKE
General Manager
Foundry Div., Eaton Mfg. Co.

Prominence in the foundry industry of Edward C. Hoenicke, general manager, Eaton Manufacturing Co.'s foundry division developed out of his introduction to the industry by way of a manufacturing apprenticeship in foundry operation, patternmaking, and machine construction with Oliver Machinery Co., Grand Rapids, Mich., in 1916. He held numerous positions with companies engaged in foundry operations in Detroit, and was foundry adviser and expediter with General Motors Corp. when he was named sales manager of the Holley Permanent Mold Machine Co. Since then he has remained in the permanent mold casting field. Mr. Hoenicke is a past chairman of the Detroit Chapter of A.F.S. and a past director of GIES and NFA. Currently, he is secretary-treasurer of the Gray Iron Research Institute. He has appeared before a number of the Society's chapters and other foundry groups, and has written for trade and technical publications in this country and abroad. He organized the Gray Iron Foundry Industry Advisory Committee for the War Production Board, and served as first head of the Gray Iron Castings Section. He is now a member of the committee, representing the permanent mold gray iron founders.

Convention News Story . . .

At Old Timers' Registration Booth were Secretary Emeritus R. E. Kennedy, Georgina Wylie, A.F.S. Staff, and A.F.S. Past President (1907) Wm. H. McFadden

F. W. Horlebein delivers Presidential Address at the Annual Meeting.

A.F.S. Secretary-Treasurer Wm. W. Maloney speaking at the Annual Business Meeting of the Society, May 10.

A capacity crowd filled the Auditorium's Grand Ballroom to hear W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va., deliver the annual Hoyt Lecture on May 10.

At President's Reception, Secretary and Mrs. Maloney, President and Mrs. Horlebein and Vice-President and Mrs. Woody greet Mr. and Mrs. Frank Dost of Cleveland.

FOR VARIETY, number of operating exhibits, and new developments disclosed the 1950 A.F.S. Foundry Congress and Show held in Cleveland, May 8-12, was unsurpassed, according to experienced observers. Veteran attendants of Society Conventions could not recall when they had seen such an array of equipment and supplies for the foundry industry or had participated in so many technical sessions, shop courses, round table luncheons, and official 54th A.F.S. Convention social functions.

Tempo of the five-day meeting built up rapidly to the mid-week highlights, the Annual Business Meeting and the Annual Banquet with National President E. W. Horlebein presiding at both. Held on Wednesday instead of the end of the week as in previous years, the Banquet was attended by over 700, a new high. Banquet features included presentation of A.F.S. Gold Medals and Honorary Life Memberships (pages 40-41 this issue) and an address, "*Students of Liberty*," by Leonard E. Read, president of the Foundation for Economic Education, at Irvington-on-Hudson, N. Y.

At the Annual Business Meeting President Horlebein made his presidential address reporting past year's activities and future plans, and presented certificates and $100 checks to the five first place winners in the 27th Annual A.F.S. Apprentice Contest (page 60).

Greetings from the foundrymen of their respective countries were presented at the Annual Business Meeting by Noel P. Newman, Newman, Hender & Co., Ltd., of England, president of the Institute of British Foundryman; John L. Sissener, consultant, chairman of the Norwegian Foundrymen's Technical Society; and Sven H. Toresson, A. B. Gotaverken, long active in the Swedish Foundrymen's Association.

President Horlebein announced that the 1951 A.F.S. Convention, a non-exhibit Foundry Congress, would be held in Buffalo, N. Y., with the time tentatively set for the last week in April.

Election of officers and directors for 1950-51 was announced by Secretary-Treasurer Wm. W. Maloney,

Convention technical session and shop course speakers and chairmen. (Left photo) May 11 Plant & Plant Equipment Session, starting left: R. Babcock, Linde Air Products Co.; M. R. Hanson, DoALL Co.; James Thomson, Continental Foundry & Machine Co.; R. J. Wolf, Stone & Webster Engineering Corp., S. F. Krzeszewski, American Wheelabrator & Equipment Corp. (Center photo) May 9 evening Sand Shop Course, left to right: J. B. Caine, consultant, Wyoming, Ohio; Dr. H. Ries, chairman, A.F.S. Sand Division; E. J. Bush, Naval Gun Factory, Washington, D. C.; and R. H. Olmstead, Whitehead Brothers Co. (Right photo) Gray Iron Round Table Luncheon, May 10, left to right: F. S. Brewster, Harry W. Dietert Co.; W. F. Bohm, Buick Motor Co.; R. A. Clark, Electro Metallurgical Div., Union Carbide & Carbon Corp.; Clyde A. Sanders of the American Colloid Co.; and Professor Charles C. Sigerfoos of Michigan State College.

who declared Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, elected president, and Walter L. Seelbach, Superior Foundry, Inc., Cleveland, vice-president (page 54).

Following the Annual Business Meeting W. W. Levi, Lynchburg Foundry Co., Radford, Va., delivered the Charles Edgar Hoyt Annual Lecture, top technical feature of the A.F.S. Annual Convention. He spoke on "*Operation of the Cupola.*" Gosta Vennerholm, Ford Motor Co., Dearborn, Mich., chairman of the Annual Lecture Committee, presided.

Social highlights of the Convention included the President's Reception, the International Reception attended by foundrymen, visitors, and consular representatives from 15 foreign countries, (details and pictures in the June issue of AMERICAN FOUNDRYMAN), the A.F.S. Alumni Dinner, the Canadian Dinner, the Chapter Officers and Directors Dinner, and the Past President's Breakfast. Running concurrently with the Convention technical and social program was the ladies entertainment program in which well over 400 participated.

A.F.S. National President E. W. Horlebein presents awards to five divisional winners in the 1950 A.F.S. Apprentice Contest at the Annual Business Meeting on May 10. Starting left, Mr. Horlebein, Eugene W. Chmielowicz (Wood Patternmaking); John W. Burkholder, Jr., (Metal Patternmaking); Worth Cropp, Jr., (Non-Ferrous Molding); Richard C. Tracy (Steel Molding); and Richard Bowman (Gray Iron Molding). See story page 60 for pictures and details on all the 1950 Contest winners.

At the A.F.S. Alumni Dinner past officers, directors, medalists, and honorary life members gathered under the chairmanship of Past-President (1949) W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, to reminisce and to hear Col. Jack Major speak on the national economy. Oldest past-president in point of service attending was Wm. H. McFadden, Southland Royalty Co., Fort Worth, Texas, president in 1907, who with C. E. Hoyt, longtime A.F.S. exhibits manager and now alumni secretary, headed the list of distinguished foundrymen present. International guests included Robert Ronceray, Ph. Bonvillain & E. Ronceray, of France, whose late father, Dr. E. V. Ronceray, received an A.F.S. gold medal in 1926, third year they were awarded.

Presiding at the heavily-attended Canadian Dinner was National Director E. N. Delahunt, Warden King, Ltd., Montreal. Among those at the head table were Past-President (1909) L. L. Anthes, Anthes-Imperial, Ltd., Toronto, and Director-Elect J. J. McFadyen, Galt Malleable Iron Co., Galt, Ontario, Canada.

Chapter officers and directors attending the dinner meeting arranged for them compared notes on chapter operation and heard a talk on human relations by R. L. Lee, General Motors Corp., Detroit. National President E. W. Horlebein was presiding officer.

Other organizations participating in the A.F.S. An-

nual Convention included those which took advantage of the Society's annual offer of gratis exhibit space, and those holding scheduled meetings during Foundry Week. Organizations exhibiting were: Foundry Educational Foundation, Foundry Equipment Manufacturers Association, Gray Iron Founders' Society, National Foundry Association, and Non-Ferrous Founders' Society.

In addition to meetings of these organizations the National Castings Council met and the Cope and Drag Club held its first Convention meeting.

New this year was a display sponsored by the A.F.S. Pattern Division and arranged under the direction of National Director V. J. Sedlon, Master Pattern Co., Cleveland. The Division's booth gave recognition to the A.F.S. group's activities and showed the variety of operations and products possible in the modern pattern shop. Across the aisle was the largest A.F.S. Apprentice Contest exhibit to date containing 98 castings and patterns representing the best of the 267 entered from all parts of the United States and Canada. Nearby, Cleveland Trade School, had its 1950 Foundry Congress and Show booth.

Visitors from abroad added an international touch to a number of the meetings including the technical sessions at which the exchange papers from the Institute of British Foundrymen and from France's Association Technique de Fonderie were presented. Author of the IBF exchange paper, Frank Hudson, Mond Nickel Co., London, who spoke on "*Aluminum Alloy Castings—A Review of British Achievement*," was leader of the British Brass Foundry Productivity Team which attended the Convention en masse.

Also attending the Convention was the Norwegian Foundry Productivity Group headed by John L. Sissener. Jean Maurice Laine, director of France's Advanced Foundry School, was unable to be present to deliver his exchange paper, "*Formation of Higher Technical Foundry Staffs in France*," and this was presented by title at the Annual Business Meeting.

Opening day of the Convention was designated Northeastern Ohio Day in honor of the host chapter. Local foundrymen were admitted free to exhibit halls and technical sessions from 1:00 to 9:30 p.m. and some 3000 took advantage of the opportunity to see and hear the latest in foundry developments and advances.

Foundrymen unable to participate in the Convention will be able to benefit from the technical meetings through this year's edition of TRANSACTIONS OF A.F.S., available this fall.

Convention technical activities got under way the morning of Monday, May 8, with meetings on light metals, brass and bronze, and malleable iron. At the session sponsored by the Aluminum and Magnesium Division, L. W. Eastwood, Battelle Memorial Institute, Columbus, Ohio, provided the commentary for the motion picture which summarizes the second phase of A.F.S.-sponsored research in fluid flow. The film shown is expected to be as popular as the initial movie on flow seen for the first time at last year's Convention, and is already scheduled for a number of chapter meetings and plant training sessions. Film title is "*Fluid Flow in Transparent Molds —II*." Presiding at the meeting were R. F. Thomson, International Nickel Co., Detroit, and C. E. Nelson, Dow Chemical Co., Midland, Mich.

D. W. Grobecker, Los Alamos Scientific Laboratory,

In Appreciation

Congratulations and thanks of the foundry industry and of those reaping the benefits of better castings—which is to say, everyone —are due all who helped make the 54th Annual A.F.S. Foundry Congress and Show an acknowledged outstanding success. Commendation is due:

To the exhibitors—equipment manufacturers, suppliers, and foundry service organizations—who this year displayed more new tools for the foundry industry in a more interesting and informative way than in any previous year.

To the technical speakers and session chairmen who, with the various program and papers committees and general interest committees, provided and arranged a diversified program of technical papers, A.F.S. committee reports, round tables and shop courses.

To the members of A.F.S. — present and prospective — who filled exhibit halls and Convention sessions and who participated freely in the cooperative interchange of foundry information which makes Society activities so beneficial.

To the A.F.S. divisions and committees who, despite crowded Convention schedules, held meetings to appraise current accomplishments, plan new work, and prepare for the 1951 Convention.

Pictured below at the A.F.S. Pattern Division's exhibit at the 54th Foundry Congress are Division members who were responsible for organizing the first exhibit of its kind to be sponsored by a technical division.

Los Alamos, N. M., presented his paper on *"An Investigation of Melting and Casting Procedures for High Purity Nickel"* at the opening session sponsored by the Brass and Bronze Division. He described techniques for producing 99 per cent pure nickel castings which successfully passed radiographic tests.

In the second paper, R. I. Moore, Wilson Brass & Aluminum Foundry Co., Toronto, described means of achieving higher efficiencies in his paper *"Metal Melting—Application of Thermodynamic Principles to Melting Non-Ferrous Metals."* J. J. Curran, Walworth Co., Greensburg, Pa., and A. K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee, were chairman and co-chairman, respectively.

R. W. Heine, University of Wisconsin, led off for the Malleable Division with a discussion of *"Some Effects of Deoxidizing Additions on Malleable Irons."* This is a foundry-scale continuation of his earlier laboratory work. In their paper *"Subcritical Isothermal Graphitization,"* H. A. Schwartz, J. D. Hedberg, and R. Eriksen, National Malleable & Steel Castings Co., Cleveland, pointed out that the rate of secondary graphitization in white iron cannot be defined without first defining the conditions of an intermediate stage of graphitization going on during the cooling process.

H. C. Stone, Belle City Malleable Iron Co., Racine, Wis., and E. Roby, Jr., Peoria Malleable Casting Co., Peoria, Ill., were chairman and co-chairman, respectively of the session.

At the Aluminum and Magnesium Division's Round Table Luncheon, Walter Bonsack, Christiansen Corp., Chicago, and H. J. Rowe, Aluminum Co. of America, Pittsburgh, presided over a discussion on *"Test Bar Gating."* Committee report on which the discussion was based appeared in the April issue of AMERICAN FOUNDRYMAN.

Attendants at the afternoon brass and bronze session heard a progress report on A.F.S.-sponsored research and a discussion of superheating and casting temperatures. B. N. Ames presented a paper co-authored with N. A. Kahn, also of the New York Naval Shipyard, Brooklyn, entitled *"Effect of Superheat and Casting Temperature on Properties of Tin Bronze."*

F. B. Rote, University of Michigan, delivered the progress report on the Society's Brass and Bronze Research Project in a paper entitled *"Melt Quality and Fracture Characteristics of 85-5-5-5."* Presiding was George J. Barker, University of Wisconsin, with H. J. Roast, consultant, Westmont, Que., as co-chairman.

A.F.S. National President E. W. Horlebein, Vice-President Walton L. Woody, and Secretary-Treasurer Wm. W. Maloney photographed on the President's inspection of exhibits preceding opening of the 54th Show.

Mrs. Edwin W. Horlebein, First Lady of A.F.S., poured at a tea given the afternoon of May 8 at the Hotel Cleveland, opening a four-day Ladies' Program.

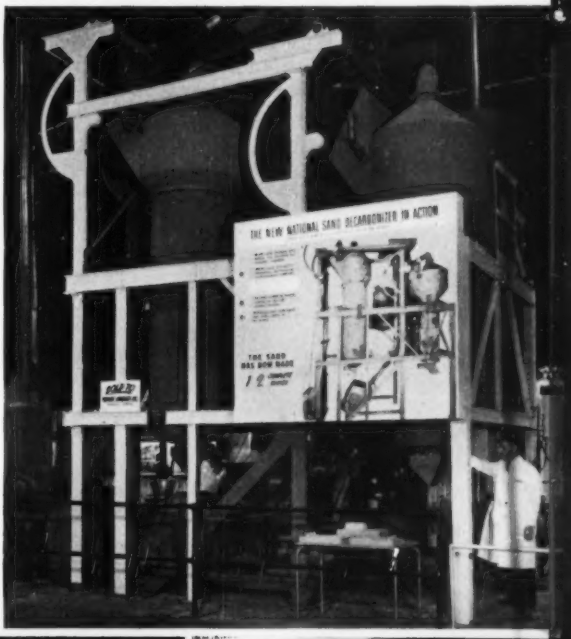
Reports On Malleable Research

At the day's second malleable session S. H. Bush, University of Michigan, presented a final report on another A.F.S. research project, *"Surface Hardening of Pearlitic Malleable Iron."* He summarized the work investigating the best microstructure and technique for flame and induction hardening. At the same session—presided over by F. W. Jacobs, Lake City Malleable Iron Co., Ashtabula, Ohio, and R. P. Schauss, Illinois Clay Products Co., Chicago—W. D. McMillan, Interna-

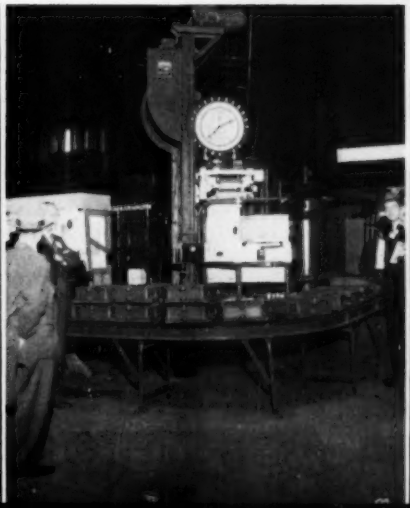
NEW TOOLS FOR THE FOUNDRY INDUSTRY

EXHIBITED AT THE 54th A. F. S. FOUNDRY CONGRESS & SHOW

SELECTED AT RANDOM FROM A VARIETY OF NEW FOUNDRY PRODUCTS THAT HAVE CONTRIBUTED TO MAKING THE 1950 A.F.S. FOUNDRY CONGRESS AND SHOW A MECCA FOR FOUNDRYMEN FROM ALL OVER THE WORLD ARE A FEW OF THE NEWEST TOOLS OF THE FOUNDRY CRAFT, SHOWN ON THIS PAGE AND ON PAGES 43 AND 47.



Starting clockwise from top left: (1) A method of producing any number of expendable core boxes with mirror-like finishes, without hand finishing or tooling. (2) Automatic high-frequency dielectric core dryer that cuts core drying time from hours to minutes. (3) Thermal treatment unit that permits repetitive use of foundry core sand. (4) Air causes sand to flow into box and also clamps in this rapid, single-lever core blower that averages 2200 shots per hour. (5) Similar in operation to a coreblowing machine, this unit blows green sand molds ready for pouring. (6) High small particle collection efficiency is combined with low pressure drops, plus low maintenance and extreme flexibility in this dust collector that operates on aerodynamic principle.

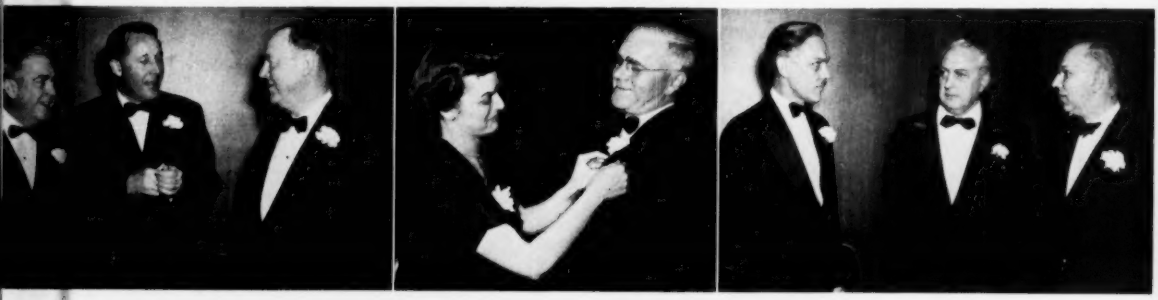


metals session. The paper evaluated the current and potential status of magnesium foundries in Canada.

"Equipment for Degassing Magnesium Alloy Melts" was the subject of Alex J. Juroff, Duramold Castings, Inc., Mishawaka, Ind. He described the design and use of chlorine degassing apparatus which can be constructed in any shop (AMERICAN FOUNDRYMAN, March, page 28). Chairmen of the session were Manley E. Brooks, Dow Chemical Co., Bay City, Mich., and E. J. Vargo, Wellman Bronze & Aluminum Co., Cleveland.

The new non-ferrous shop course and the traditional Gray Iron and Sand Shop Courses combined with the Non-Ferrous "Son-Father" Dinner and the Chapter Officers and Directors Dinner to end the first day of Convention activity. Sponsored by the Non-Ferrous Founders' Society and open to all interested non-ferrous foundrymen, the "Son-Father" dinner was attended by a number of foundry families with fathers and grandfathers guests of the younger generation.

Martin G. Dietl, Crane Co., Chicago, led the first of his two Non-Ferrous Shop Course discussions on



Photographed at the Speakers' Table Reception preceding the Annual Banquet of the Society were, left to right, Secretary-Treasurer Wm. W. Maloney, Speaker Leonard Read, and Past National President Duncan Forbes. (Center photo) Alice Brown of A.F.S. National Office pins traditional white carnation on President E. W. Horlebein. (Right photo) Lieut. Colonels Earl D. Payne (left) and Frank Holmes, liaison officers from the Munitions Board to the foundry industry, with Technical Director S. C. Massari.

tional Harvester Co., Chicago, spoke on *"Furnace Atmosphere for Malleable Annealing."* He described use of high nitrogen and inflammable atmospheres.

Two papers sponsored by the Precision Investment Casting Committee were presented at a session at which L. E. Grubb, International Nickel Co., Bayonne, N. J., and T. E. Moore, Ransom & Randolph Co., Toledo, Ohio, were co-chairmen.

In their paper *"Casting Aluminum in Moist Investment Molds,"* S. Lipson and H. Rosenthal, Frankford Arsenal, Philadelphia, described a technique for improving the properties of aluminum alloys cast by the precision investment process (AMERICAN FOUNDRYMAN, April, page 122). Following Mr. Lipson's presentation, E. I. Valyi, A.R.D. Corp., New York, discussed *"Pattern Materials and Production in Precision Investment Casting."* He explained methods of modifying wax compositions, of developing pattern plastics, and use of metal patterns.

M. W. Martinson presented *"Magnesium Foundry Practice in Canada,"* written with J. W. Meier, Bureau of Mines, Ottawa, Ont., at the late afternoon light melting at an evening meeting presided over by J. L. Stroman, Stroman Furnace & Engineering Co., Franklin Park, Ill. He discussed practical operating techniques of gas, oil, and solid fuel furnaces. Held for the first time this year, the Non-Ferrous Shop Course is expected to become as popular as the off-the-record Sand and Gray Iron Shop Courses have become over the many years since their inception.

At the Gray Iron Shop Course the first night of the Convention, E. W. Deutschlander, Worthington Pump Co., Buffalo, N. Y., led a discussion on *"Pouring Practice for Gray Iron."* Presiding were K. H. Priestley, Vassar Electroloy Products, Inc., Vassar, Mich., and E. J. Burke, Hanna Furnace Corp., Buffalo.

"Core and Mold Blowing" was the subject of the Sand Shop Course session at which Frank S. Brewster, Harry W. Dietert Co., and E. L. Thomas, Cadillac Motor Car Div., GMC, both of Detroit, presided. Discussion panel included A. E. Czechowicz, Key Co., East St. Louis, Ill.; R. W. Gardner, Ford Motor Co., Dearborn, Mich.; and L. D. Pridmore, International Molding Machine Co., LaGrange Park, Ill.

Presentation of A.F.S. Gold Medals and Honorary Life Memberships at the Annual Banquet of American Foundrymen's Society, held Wednesday evening, May 10, in the Grand Ballroom of the Statler Hotel, Cleveland. Starting from top: (1) Past National President and McFadden Medalist Max Kuniansky presents A.F.S. McFadden Gold Medal to Prof. Richard Schneidewind of the University of Michigan, (2) Past President and Medalist G. H. Clamer (left) congratulates C. H. Lorig of Battelle Memorial Institute after presenting him with the A.F.S. Seaman Gold Medal, (3) Ralph L. Lee of General Motors Corp. (left) was presented with an Honorary Life Membership in the American Foundrymen's Society by Past President and Medalist F. J. Walls, and (4) Medalist Howard Taylor of the Massachusetts Institute of Technology (left) presented an Honorary Life Membership in A.F.S. to Clyde Frear, U. S. Naval Bureau of Ships.

TUESDAY, MAY 9

Malleable iron, light metals, and copper-base alloys dominated the technical discussions the second day of the Convention, Tuesday, May 9. Sessions also held covered sand, education, heat transfer, and patterns.

Progress on the A.F.S.-sponsored Heat Transfer Research Project was reported by V. Paschkis, Columbia University, in a paper on *"Influence of Dry Sand Conductivity on Rate of Freezing of Steel Slabs."* Object of the investigation reported was to find out how time of solidification changes if sands with different properties are used as mold material.

"Solidification of Ingots" by B. H. Alexander, Sylvania Electric Products, Inc., Bayside, L. I., N. Y., preceded the research paper at the session sponsored by Heat Transfer Committee. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, and E. C. Troy, foundry engineer, Palmyra, N. J., were chairman and co-chairman.

Walter E. Sicha, Aluminum Co. of America, Cleveland, presented the paper he co-authored with H. Y. Hunsicker of Alcoa, *"New Aluminum-Zinc-Magnesium-Copper Casting Alloys,"* at the first of three Tuesday light metals sessions. Developments reported led to the selection of two new compositions, one for sand castings, another for permanent mold work, he said.

"Corrosion and Stress Corrosion Properties of a High Strength Aluminum-Zinc-Magnesium-Copper Casting Alloy" was the subject of a paper by R. A. Quadt and E. C. Reichard, American Smelting & Refining Co., Barber, N. J., delivered by Reichard. Results reported were for a high-strength, self-aging, sand-cast alloy. Chairman and co-chairman, respectively, were R. E. Ward, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., and W. E. Carver, Light Metals, Inc., Indianapolis, Ind.

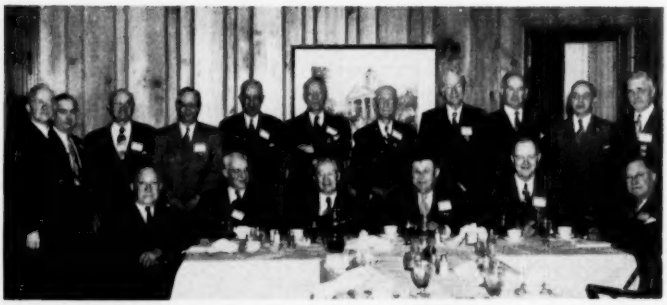
William Romanoff, H. Kramer & Co., Chicago, and G. K. Eggleston, Barnes Mfg. Co., Mansfield, Ohio, presided at the morning brass and bronze meeting. Papers presented were *"Metal Specifications for Brass and Bronze Foundry,"* by James G. Dick, Canadian Bronze Co., Ltd., Montreal, and *"Aluminum Additions in Commercial Yellow Brass,"* by R. A. Colton and R. H. Gilbert, American Smelting & Refining Co.

influence of only a few factors is understood at present. Nevertheless, he said, in delivering his paper entitled *"A Summary of the Quantitative Effects of Some Factors on the Annealing of White Cast Iron,"* if careful data are secured on a given casting, approximate predictions may be made for other castings made under similar conditions. Presiding were H. Hunt, Auto Specialties Mfg. Co., St. Joseph, Mich., and F. Wurscher, Marion Malleable Iron Co., Marion, Ind.

Hold Round Table Discussions

The ever-popular subject of eliminating casting defects was the topic of discussion led by Howard F. Taylor, Massachusetts Institute of Technology, at the Brass and Bronze Round Table Luncheon Tuesday noon. Presiding at the informal session were B. A. Miller, Baldwin Locomotive Works, Philadelphia, and H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh.

Simultaneously, malleable foundrymen held their round table luncheon under the chairmanship of J. H. Lansing, Malleable Founders' Society, Cleveland, and Carl F. Lauenstein, Link-Belt Co., Indianapolis, Ind. Two topics discussed were *"Effect of Excessive Oxidation in Duplex Melting"* and *"Design of Dies for Straightening."* On the discussion panel were Milton Tilley, National Malleable & Steel Castings Co., Cleveland (his paper appears on page 88, this issue), H. C. Stone, Belle City Malleable Iron Co., Racine, Wis.,



Former top executives of the Society attending the Annual Past President's Breakfast, May 11, covered a span of nearly half a century. They were: G. H. Clamer (1924), Secretary Emeritus R. E. Kennedy, Retired A.F.S. Executive Vice-President C. E. Hoyt, Max Kuniansky (1948), Duncan Forbes (1943), and W. B. Wallis (1949). Standing, left to right: J. L. Wick (1937), National Secretary-Treasurer Wm. W. Maloney, Hyman Bornstein (1938), Fred J. Walls (1946), W. T. Bean (1922), L. L. Anthes (1909), Ben D. Fuller (1918), Wm. H. McFadden (1907), Marshall Post (1939), Ralph J. Teetor (1945), and Edwin W. Horlebein, present National President of the American Foundrymen's Society.

Mr. Dick outlined the development of specifications for composition ingot metal at his company. Mr. Colton pointed out that it is controversial whether aluminum additions are beneficial or detrimental. He reported optimum castability and pleasing color at an aluminum content of 0.2 per cent. Details are in the April issue of AMERICAN FOUNDRYMAN, page 135.

"Acceptance of pearlitic malleable castings in new fields of application is based on quality," said D. T. Martin, Saginaw Malleable Iron Plant, Saginaw, Mich., at the Tuesday morning malleable session. His paper was titled *"Outline of Inspection for Pearlitic Malleable Castings."*

At the same session, Richard Schneidewind, University of Michigan, reported that it is impossible to compute annealing rates of malleable iron from the chemical composition or any other factor since the exact

Session Vice-Chairman Clyde B. Jenni, General Steel Castings Corp., Eddystone, Pa., left, and Chairman Charles Locke, Armour Research Foundation, Chicago, listen to Speaker E. C. Troy, foundry engineer, Palmyra, N. J., opening a Joint Sand and Steel Symposium in the Auditorium Ballroom, afternoon of May 11.

Starting clockwise from top left: (1) High-frequency induction unit for ignition of samples in carbon and sulphur determinations. (2) Machine for making molds from large matchplate patterns mechanizes five major operations. (3) Suspended pouring system features full-vision, easy-to-handle controls. (4) Power wheelbarrow handles a variety of foundry jobs. (5, inset) Low-cost laboratory sand mixer is readily adjustable, simply and sturdily constructed. (6) Gravimetric principle of this moisture tester permits complete, accurate material tests in from two to five min. (7) Portable bucket elevator eliminates molder sand handling.

NEW TOOLS FOR THE FOUNDRY INDUSTRY

EXHIBITED AT THE 54th A. F. S. FOUNDRY CONGRESS & SHOW

Harold G. Sieggreen, Central Foundry Div., GMC, Saginaw, Mich., and K. L. Sanders, Albion Malleable Iron Co., Albion, Mich.

The official exchange paper from the Institute of British Foundrymen to A.F.S. was presented by Frank Hudson, Mond Nickel Co., London, at the early afternoon aluminum and magnesium session. Title of the paper was *"Aluminum Alloy Castings—A Review of British Achievement."* Presiding was A.F.S. Technical Director S. C. Massari, with Hiram Brown, Solar Aircraft Co., Des Moines, Iowa, as co-chairman. In introducing his paper, Mr. Hudson said that British aluminum founders outstripped other branches of the industry in regard to progressive outlook on development and production of quality castings.

At the Convention's initial sand session, H. W. Lownie, Battelle Memorial Institute, Columbus, Ohio, presented *"Treatment of Bond Clays for Foundry Sand"* for the author, A. E. Pavlish, Kelly Island Lime & Transport Co., Cleveland. The paper reported the effects of various lignin binders on the properties of clay-bonded sands.

Second paper at the session, *"Phenolic Resin Core Binders—Effect of Core Mix on Physical Properties,"* was presented by J. E. McMillan, Monsanto Chemical Co., Springfield, Mass. Co-author was J. A. Wickett of Monsanto. H. K. Salzberg, Borden Co., Bainbridge, N. Y., and Earl E. Woodliff, Foundry Sand Service Engineering Co., Detroit, were chairmen.

Magnesium alloys were discussed at the late afternoon light metals session. K. E. Nelson and F. P. Strieter, Dow Chemical Co., Midland, Mich., presented *"Casting of Magnesium-Rare Earth-Zirconium Alloys in Sand,"* and J. W. Meier presented *"Development of High-Strength Magnesium Casting Alloy ZK61,"* co-authored with M. W. Martinson, also of the Bureau of Mines, Ottawa, Ont.

Nelson and Strieter's paper dealt with magnesium alloys for elevated temperature use in aircraft. The Canadian paper covered an extensive investigation of

Shown above are members of a British Brass Foundry Productivity Team attending the 54th A.F.S. Foundry Congress and Show, and (right on facing page) a Norwegian Foundry Productivity Group, both under ECA sponsorship. Photographs were taken at the International Reception on the afternoon of Tuesday, May 9.

Some of the officers of the foundry organizations making up the National Castings Council—American Foundrymen's Society, Gray Iron Founders' Society, Malleable Founders' Society, Foundry Equipment Manufacturers' Association, Steel Founders' Society, National Foundry Association, Foundry Facing Manufacturers' Group, and Non-Ferrous Founders' Society—who met at breakfast Wednesday, May 10, and elected A.F.S. President E. W. Horlebein (seated, left) to the presidency of the Council.

Shown viewing an exhibit of German and Swedish gray iron art castings, displayed through the courtesy of George W. Cannon and Henry J. Trenkamp are, left to right: Rolf Landmark, attached to Norwewian Attache, Washington, D. C.; Thomas Lewander of Sweden; Dr. Reinhold Crummenauer of Germany; A.F.S. President E. W. Horlebein; George Zehnder of Switzerland; George W. Cannon; and Dr. Franz Grosser, German foundryman, who made most of the castings.

casting alloys based on the Mg-Zn-Zr system. Presiding were R. T. Wood, American Magnesium Corp., Cleveland, and J. C. McDonald, Dow Chemical Co., Midland, Mich.

"High School and Trade School Training" were discussed at a round table meeting sponsored by the A.F.S. Educational Division Tuesday afternoon. On the discussion panel were W. J. MacNeill, Dayton Malleable Iron Co., Dayton, Ohio, R. Verne Righter, Central Foundry Div., GMC, Saginaw, Mich., and Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio. Training methods and encouraging young men to enter the foundry industry were discussed. A. W. Gregg, Whiting Corp., Harvey, Ill., and W. H. Ruten, Brooklyn Polytechnic Institute, Brooklyn, presided at the round table.

Three papers were presented at the afternoon meeting sponsored by the Pattern Division. Co-chairmen of the session were J. Mathias, Accurate Matchplate Co., and A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee. Kurt A. Miericke, Baroid Sales Div., National Lead Co., Chicago, spoke on *"Making Pressure Cast Aluminum Matchplates in Plaster Molds."*

"Production Patterns and the Matchplate" was the subject of a paper by R. F. Dalton, U. S. Gypsum Co., Chicago. The session closed with *"Cold Formed Flexible Precision Patterns and Core Boxes"* by J. E. Wiss and R. B. Wagner, Perma-Flex Mold Co., Columbus.

The International Reception, held late Tuesday afternoon, provided an opportunity for foundrymen from all over the world to get acquainted with each other and the officers of A.F.S. Canadians, so numerous in the Society that they have had a special Convention function for a number of years, were over 200 strong at the traditional Canadian Dinner.

Rounding out Educational Division activities was the Educational Dinner, Tuesday evening, with papers on apprenticeship and engineering training. Ben D. Claffey, Acme Aluminum Alloys, Inc., Dayton, Ohio, and George K. Dreher, Foundry Educational Foundation, Cleveland, were co-chairmen.

Frank W. Shipley and Bert L. Bevis, Caterpillar Tractor Co., Peoria, Ill., detailed their company's extensive training program in their paper *"Foundry Apprentice Training at Caterpillar Tractor Co."* Reaction of engineering college students to the foundry industry was reported in a survey entitled *"The Engineering Student and Summer Foundry Work"* by Norman J. Stickney, University of Wisconsin.

Three shop courses completed the program for the second day of the Convention. In a paper scheduled for publication in AMERICAN FOUNDRYMAN, B. P. Mulcahy, consultant, Indianapolis, Ind., covered *"Cupola Bed Practice."* E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y., was chairman of this Gray Iron Shop meeting.

Giving his second Non-Ferrous Shop Course talk, Martin G. Dietl, Crane Co., Chicago, spoke on *"Electric Furnace Melting."* Presiding was B. W. Schafer, Kuhlman Electric Co., Bay City, Mich. The core dip test he developed was the subject of discussion by J. B. Caine, consultant, Wyoming, Ohio, at the Sand Shop Course. E. J. Bush, U. S. Naval Gun Factory, Washington, D. C., was chairman; co-chairman was R. H. Olmstead, Whitehead Bros. Co., New York.

WEDNESDAY, MAY 10

The subject which brought out a record crowd at last year's Convention—nodular iron—drew heavily this year as foundrymen came out to hear two papers at a joint session sponsored by the Gray Iron and

Reminiscing over several decades of past foundry shows were these veteran A.F.S. Convention-goers. Left to right: Past National President Wm. H. McFadden (1907); Retired A.F.S. Executive Vice-President C. E. Hoyt; Past President (1918) Ben Fuller.

Malleable Divisions of A.F.S. H. Bornstein, Deere & Co., Moline, Ill., and T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa., presided at this meeting.

First speaker was Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., who described his company's experiences in the field of nodular iron in his paper *"Problems in Producing Ductile Iron."* J. E. Rehder, Bureau of Mines, Ottawa, Ont., explained mechanism and property changes in a paper entitled *"An Introduction to the Annealing of Nodular Iron."*

R. H. Stone, Vesuvius Crucible Co., Pittsburgh, and Ray Witschey, A. P. Green Firebrick Co., Chicago, were chairman and co-chairman at the Wednesday morning meeting sponsored by the Refractories Committee. R. H. Jacoby, Key Co., East St. Louis, Ill., presented the paper he wrote with Marshall Petty, Key Co., *"Refractory Practice in Melting of Acid Electric Steel."* In the paper (AMERICAN FOUNDRYMAN, April, page 117) the authors presented information useful as a guide in establishing or improving refractory practice in foundries producing medium-small steel castings.

Suggestions for achieving greater sand testing accuracy and duplication of results were given in a paper, *"Reproducibility of Foundry Sand Tests,"* presented at the Wednesday morning sand session. Authors of the paper reporting the results of tests carried out by the Green Sand Properties Committee were Bradley H. Booth, Carpenter Brothers, Inc., Milwaukee, P. C. Rosenthal, University of Wisconsin, and Harry W. Dietert, Harry W. Dietert Co., Detroit.

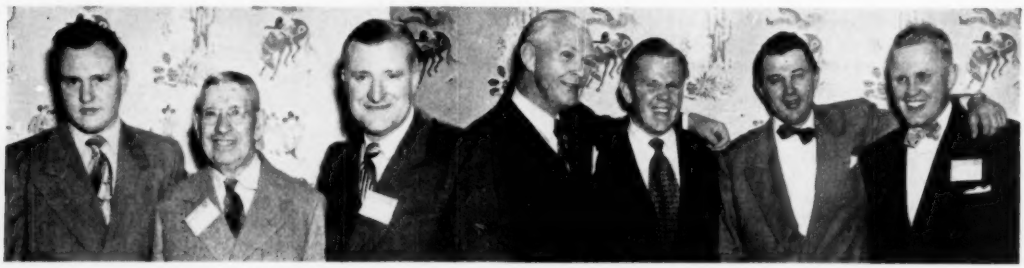
Report On A.F.S. Sand Research

Presented at the same session, under the chairmanship of Clyde B. Jenni, General Steel Castings Corp., Eddystone, Pa., and J. H. Lowe, Wehr Steel Co., Milwaukee, was the *"Tenth Annual Report on Investigation of Properties of Steel at Elevated Temperatures."* This paper on the Sand Division's research project was by R. G. Thorpe and P. E. Kyle, Cornell University.

At the Convention's first session sponsored by the Steel Division foundrymen learned about mold gases, penetration, and pinholes. C. W. Briggs, Steel Founders' Society, Cleveland, presided with R. E. Kerr, Pettibone-Mulliken Corp., Chicago, as co-chairman. *"Nature of Mold Cavity Gases"* by Charles Locke and R. L. Ashbrook, Armour Research Foundation, Chicago, outlined the variables affecting pressures which develop in a mold cavity during the pouring of a casting. Presentation was by Mr. Locke.

Gassy metal and ferrostatic pressure are significant

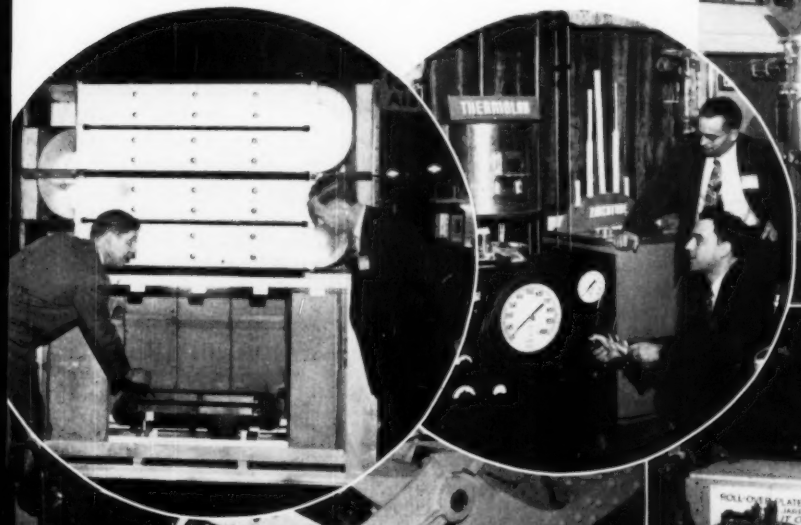
Photographed at the Non-Ferrous Founders' Society's "Son-Father" Dinner, Monday evening, May 8, were these foundry families. The three gentlemen at the left represent three generations of foundrymen—Lee Schneider, age 20; his grandfather, William Schneider, age 88; and his father Arthur L. Schneider, age 50, all of Western Brass & Bronze Foundry, Denver, Colo. Next is Alvin E. Jacobson of Grand Haven Brass Foundry, Grand Haven, Mich., and his foundryman sons—David, Charles and Alvin E., Jr.

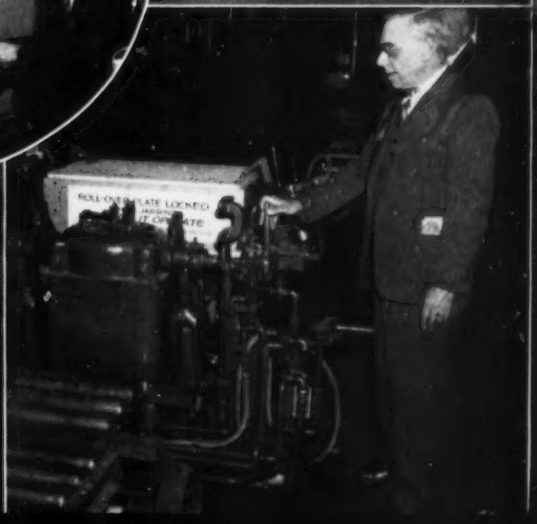


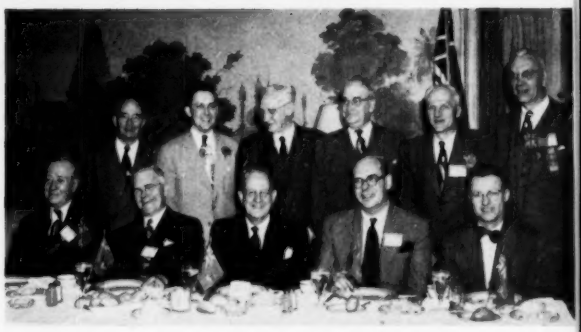
NEW TOOLS FOR THE FOUNDRY INDUSTRY

EXHIBITED AT THE 54th A. F. S. FOUNDRY CONGRESS & SHOW

Clockwise from top left: (1) Background, all-purpose sand blower. Foreground, lightweight, portable, rapid sand mixer. (2) British molding machine with turnover head jolts, squeezes, draws patterns. (3) Machine pneumatically transports sand and flowable materials. (4) Molding machine features automatically locked rollover plate and jar head. (5) Shark's tooth bucket feathers coke, drops out fines. Removable lip can be attached for sand handling. (6, left circle) Hot blast system for preheating cupola air. (7) Dilatometer studies sand at pouring temperatures.







Canadian Foundry notables and A.F.S. officials taking part in the traditional Canadian Dinner, held the evening of May 9 in the Empire Room of the Hotel Cleveland were: (seated, left to right), A.F.S. National Director E. N. Delahunt, Warden King Ltd., Montreal; A.F.S. President E. W. Horlebein; A.F.S. Vice-President-Elect Walter L. Seelbach; Noel P. Newman, president, Institute of British Foundrymen; and James H. Newman, Newman Foundry Supply Co., Ltd., Montreal. (Standing, left to right): Joseph Sully of Long Branch, Ont., retired; Jack H. King, Werner G. Smith, Ltd., Toronto; A.F.S. Secretary Emeritus R. E. Kennedy; A.F.S. Director-Elect J. J. McFadyen, Galt Malleable Iron Co., Galt, Ont.; James A. Dickson, Dickson Foundry Co., Vancouver, B. C.; and A.F.S. National Vice-President Walton L. Woody.

factors in metal penetration according to S. L. Gertsman, Bureau of Mines, Ottawa, Ont., who presented *"Metal Penetration in Steel Sand Cores,"* co-authored by A. E. Murton of the Bureau. Influence of silica flour and wood flour were reported. Most probable cause of pinholes is carbon monoxide, said R. E. Savage, International Nickel Co., New York, in delivering the paper *"Thermodynamic Study of Pinhole Formation in Steel Castings."* Howard F. Taylor, Massachusetts Institute of Technology, introduced the paper, giving the background for the investigation.

"Effect of Mold Materials on Metal Shrinkage," subject of the Gray Iron Round Table Luncheon discussion, was covered by three speakers—C. C. Sigerfoos, Michigan State College; Clyde A. Sanders, American Colloid Co., Chicago; and Walter F. Bohm, Buick Motor Co., Flint, Mich. Frank S. Brewster, Harry W. Dietert Co., Detroit, presided; co-chairman was Ralph A. Clark, Electro Metallurgical Div., Union Carbide & Carbon Corp., Detroit.

Talking shop prior to the Gray Iron Shop Course held the evening of May 9 were, left to right, W. W. Levi, Lynchburg Foundry Co., Radford, Va.; Session Chairman E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.; Discussion Leader B. P. Mulcahy, consultant, Indianapolis and A.F.S. Technical Director S. C. Massari. Session dealt with cupola practice.

Discussion subject at the Pattern Round Table Luncheon was *"An Alloy Designed for Pattern Shops"* with S. Zukor, S. Greenfield Co., Buffalo, N. Y., leading the discussion. George E. Garvey, City Pattern & Foundry Co., South Bend, Ind., and H. C. Swanson, Arrow Pattern & Foundry Co., Chicago, were chairman and co-chairman, respectively.

Annual Business Meeting and Banquet

Exhibits closed at 3:00 p.m. on Wednesday, May 10, for the Annual Business Meeting and the Charles Edgar Hoyt Annual Lecture. National President E. W. Horlebein presided and delivered his presidential address on present and proposed Society activities. Following presentation of awards by President Horlebein to the five first place winners in the 27th Annual A.F.S. Apprentice Contest, National Secretary-Treasurer Wm. W. Maloney announced the election of officers and directors (page 54) who will take office at the annual meeting of the new Board the middle of the year.

"Operation of the Cupola" by W. W. Levi, Lynchburg Foundry Co., Radford, Va., this year's Hoyt Lecture, was a comprehensive discussion of cupola operating principles and techniques. Presiding was Gosta Vennerholm, Ford Motor Co., Dearborn, Mich.

Largest attendance at an A.F.S. Annual Banquet was registered the evening of Wednesday, May 10, when over 700 witnessed the presentation of A.F.S. Gold Metals and Honorary Life Memberships and heard Leonard E. Read, president, Foundation for Economic Education, speak on *"Students of Liberty."*

THURSDAY, MAY 11

Opening activities on Thursday, May 11, was a Gray Iron Session, held in the Ballroom of the Auditorium at 10:00 a.m., with A. P. Gagnebin, International Nickel Co., Bayonne, N. J., as chairman and W. B. McFerrin, Haynes Stellite Div., Union Carbide & Carbon Corp., Kokomo, Ind., as co-chairman.

First paper of the session, "*Improved Test Bars for Standard and Ductile Grades of Cast Iron*," by R. A. Flinn and R. W. Kraft, American Brake Shoe Co., Mahwah, N. J., described a newly-developed series of Y-shaped test blocks exhibiting less shrinkage and providing four times the range of cooling rates of ASTM Standard A-48 arbitration bars for gray iron.

Concluding the Gray Iron Session, R. G. McElwee, Vanadium Corp. of America, Detroit, chairman of the A.F.S. Gray Iron Division, reported on the progress to date and future plans of the A.F.S. Cupola Research Committee.

Management Functions and Controls Session at 10:00 a.m. had as its chairman Ralph L. Lee of Grede Foundries, Inc., Milwaukee, with A.F.S. National Director V. E. Zang, Unitcast Corp., Toledo, Ohio, as co-chairman of the session.

Speaking on "*Administration of Wage Incentives*," C. T. Hassell of Lester B. Knight & Associates, Inc., Chicago, stressed such points as the need for greater responsibility on the part of management, cooperation between supervision and labor, use of wage incentives for higher production, and the need for improved time study methods in the foundry.

In his talk on "*Organizing Management for Profit*," W. E. George of Booz, Allen & Hamilton, Chicago, said that this can best be accomplished by a balanced organization of executives and supervisors, using a modern plant to produce superior products for an expanding market at the lowest possible cost.

Bradley H. Booth, Carpenter Bros., Inc., Milwaukee, presided over the 10:00 a.m., May 11, Sand Session, with J. O. Ochsner of the Crouse Hinds Co., Syracuse, N. Y., as co-chairman.

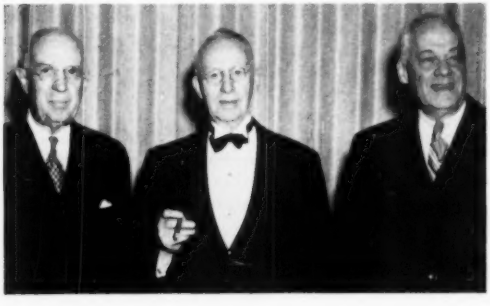
Opening the session was W. H. Moore of Meehanite Metals Corp., South Euclid, Ohio, who described the "*Flowability of Molding Sands*." Mr. Moore's talk was followed by a paper on "*Factors Affecting Molding Sand Density, Shrinkage and Workability*," written by R. P. Schauss and R. F. Baley of Illinois Clay Products Co., Chicago, in collaboration with E. E. Woodliff, Foundry Sand Service Engineering Co.

Concluding the 10:00 a.m. Thursday, May 11, sessions was a Steel Session, with R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, presiding, and D. C. Zuege, Sivyer Steel Casting Co., Milwaukee, as co-chairman.

First session speaker, G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind., in describing "*Influence of Temperature on Fluidity and Surface Appearance of Steel Castings*," cited experimental trends and new equipment for determining these influences and cited results of temperature studies in acid electric shop using 6-ton bottom-pour ladles, and in basic open earth shops using 25-ton ladles.

Final paper in the 10:00 a.m., Thursday, Steel Session was "*Steel Quality as Related to Test Bar Fractures*," by H. H. Johnson and C. A. Fisher, National Malleable & Steel Castings Co., Sharon, Pa., in which the importance of test bar fractures was demonstrated

Caught by the camera in an informal moment at the Alumni Dinner at the Cleveland Athletic Club, May 11, were, left to right, Past President W. R. Bean (1922), Past President L. L. Anthes (1909) and Past Director Harry K. Swan, Detroit foundry consultant.



Prominent foundrymen from overseas, shown with President Horlebein (third from left) at the International Reception, May 9, included, starting left, Robert Ronceray of France, son of an A.F.S. Gold Medalist; Noel P. Newman, president of the Institute of British Foundrymen; and John L. Sissener, president of the Norwegian Foundrymen's Technical Society.

Seen with Mrs. Wm. W. Maloney (center) were these Parisian foundrymen and their wives. Left to right: Mr. and Mrs. A. Lucien, representing Foundry Services Inc. in Europe and Canada; and Mr. and Mrs. Pierre J. Boissier, Usines et Acieres de Sambre-et-Meuse.

Corp. of America, Detroit; and a discussion of the *"Basic Lined Cupola"* by S. F. Carter of the American Cast Iron Pipe Co., Birmingham, Ala.

Sand Session at 2:00 p.m., May 11, had as its chairman J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind., with P. E. Kyle of Cornell University, Ithaca, N. Y., as co-chairman.

Session papers were *"A Study of the Effect of Various Binders and Additives on the Hot Strength of Molding Sands,"* by R. E. Morey and C. G. Ackerlind, Naval Research Laboratory, Washington, D. C.; and *"Effect of Moisture on Core Sand Mixtures,"* by O. J. Myers, Werner G. Smith Co., Minneapolis.

Speaking on *"Standard Data for Bench Coremaking,"* H. R. Williams, Williams Management Engineering Co., Milwaukee, cited such principles as coremaking time studies, "fill and ram" standards and classifications, curve off, tucking, slicking, strike off and draw, rap for draw, split box assembly and other operational standards as essential to good coremaking, in the 2:00

(Left) Visitors from South of the Border, shown with A.F.S. Secretary-Treasurer Wm. W. Maloney are, left to right: Eugenio D. Aleman, Metallurgica Almena, Mixcoac, Mexico; Delbert Luper, Iturbe y Zalce, Tucubaya, Mexico; Mr. Maloney; Mexican Consul B. Rios Franco; and Juan Collignon, Sr., and Juan Collignon, Jr., Cia. Mfra. de Artofactos, Guadalajara. (Right) A.F.S. Vice-President-Elect Walter L. Seelbach, Superior Foundry, Inc., Cleveland, left, and A.F.S. National Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif., discussing A.F.S. affairs at the President's Reception.

to show differences in quality by statistical methods.

Open discussion was a feature of the Steel Round Table Luncheon, held Thursday noon in the Ballroom of the Hotel Cleveland, and covered such subjects as (1) *"Fluidity Tests in Relation to Temperature and Temperature Control"* (2) *"Steel Temperature Measurement"* (3) *"Casting Surface Finish and Defects."*

Presiding at the session was A.F.S. National Director V. E. Zang, Unitcast Corp., Toledo, Ohio, with R. E. Kerr, Pettibone Mulliken Corp., as co-chairman.

Opening the Thursday afternoon, May 11, technical sessions was the 2:00 p.m. Gray Iron Session, with A. E. Schuh, United States Pipe & Foundry Co., Burlington, N. J., as chairman, and C. O. Burgess, Gray Iron Founders' Society, as co-chairman.

Papers presented were *"Composition and Properties of Gray Iron,"* by Richard Schneidewind of the University of Michigan and R. G. McElwee, Vanadium

p.m. Timestudy and Methods Session. Second paper was a *"Fatigue Data Survey,"* presented by M. E. Annich, American Brake Shoe Co., Mahwah, N. J., in which the author interpreted fatigue factor data as compiled from a questionnaire circulated by the Timestudy and Methods Committee.

Opening the 4:00 p.m. sessions was a Foundry Cost Session, with Ralph L. Lee, Grede Foundries, Inc., Milwaukee, presiding and George Tisdale, Zenith Foundry Co., Milwaukee, as co-chairman. Session speaker was J. A. Wagner of Wagner Malleable Iron Co., Decatur, Ill., who outlined cost problems from the viewpoint of foundry management.

Director-Elect James Thomson, Continental Foundry & Machine Co., East Chicago, Ind., presided at the 4:00 p.m., May 11, Plant and Plant Equipment Session, with R. J. Wolf of Stone & Webster Engineering Corp., Boston, as co-chairman. Three papers were presented:

"Oxygen Cutting Processes in Steel Foundries," by R. Babcock of the Development Division of Linde Air Products Co., Newark, N. J., described latest developments in apparatus and operating techniques for such processes as the hand blowpipe in cutting and lancing; machine cutting for removal of defects and burned sand; and powder cutting.

"Bandsawing in Foundries," by G. H. Sheppard of the DoALL Co., DesPlaines, Ill., was presented by M. R. Hanson of DoALL, and described such bandsawing processes as cutting of ferrous and non-ferrous castings and special alloys; and outlined most economical methods and materials to be used.

"Selection and Application of Cleaning Equipment," by S. F. Krzeszewski, American Wheelabrator & Equipment Corp., Mishawaka, Ind., cited six principal factors in selection of cleaning room equipment: (1) cleaning ability, (2) initial cost, (3) operating and maintenance cost, (4) safety and hygiene, (5) type of finish produced, and (6) miscellaneous factors.

attended by Past and Present Officers and Directors of the Society, Gold Medalists and Honorary Life Members, was held at the Cleveland Athletic Club at 7:00 p.m., May 11, and featured as its speaker Colonel Jack Major, noted lecturer.

Final shop courses were held Thursday evening at 8:00 p.m. in the Statler and Cleveland Hotels.

Gray Iron Shop Course had as its chairman H. H. Wilder, Eaton Mfg. Co., Vassar, Mich., with E. J. Burke, Hanna Furnace Corp., Buffalo, as co-chairman. *"Cupola Refractory Practice"* was discussed by a panel consisting of E. J. Lally, Forest City Foundries Co., and Thaddeus Giszczak, A.F.S. Metallurgist.

R. H. Jacoby, Key Co., East St. Louis, Ill., presided over the final Sand Shop Course in the Statler Hotel, with H. W. Meyer, General Steel Castings Co., Granite City, Ill., as co-chairman. G. H. Curtis, Nichols Engineering & Research Co., New York, led discussion on *"Sand Reclamation."*

Plant and Plant Equipment Session, held at 8:00

At the first Non-Ferrous Shop Course, held the evening of May 8, were, left to right: Chairman J. L. Stroman, Stroman Furnace & Engineering Co., Franklin Park, Ill.; M. G. Dietl, Crane Co., Chicago; and George P. Halliwell of H. Kramer and Co., Chicago. (Right photo) Speakers and Chairmen at the Educational Dinner, evening of May 9, were, left to right: Speaker N. J. Stickney, University of Wisconsin; Co-Chairman George K. Dreher, FEF; Speakers Frank W. Shipley and B. L. Bevis, Caterpillar Tractor Co.; FEF President S. C. Wasson; and Educational Dinner Chairman B. D. Claffey, Acme Aluminum Alloys, Inc.

Director-Elect E. C. Troy, foundry engineer, Palmyra, N. J., introduced the subject *"Interpretation of Sand Tests as Related to Steel Castings"* at the 4:00 p.m., May 11, Joint Sand and Steel Symposium.

Discussing *"Room Temperature Testing"* were J. H. Lowe, Wehr Steel Co., Milwaukee, and W. J. Downey, Burnside Steel Foundry Co., Chicago.

"High Temperature Testing" panel members were P. E. Kyle of Cornell University; R. H. Jacoby, Key Co., East St. Louis, Ill.; H. W. Meyer, General Steel Castings Corp., Granite City, Ill.; J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.; and J. B. Caine, foundry consultant, Wyoming, Ohio.

The A.F.S. Alumni Dinner, special Convention event

One of the tables at the Chapter Officers and Directors Dinner, Empire Room, Hotel Cleveland, May 8.

p.m., May 11, in the Hotel Cleveland, featured four half-hour talks: *"Foundry Cleaning Room Abrasive Operations,"* by Boyd H. Work, Carborundum Co., Niagara Falls, N. Y.; *"Salvage of Castings by Welding of Defects,"* by G. E. Bellew, Air Reduction Sales Co., New York; *"Use of Portable Air Tools in Foundry Cleaning Rooms,"* by A. G. Ringer, Ingersoll-Rand Co., New York, and *"Material Transport in the Cleaning Room,"* by N. L. Smith, Link-Belt Co., New York, and R. J. Wolf, Stone & Webster Engineering Corp.

Presiding at the session was James Thomson, Continental Foundry & Machine Co., East Chicago, Ind. Co-chairman was H. W. Johnson, Wells Mfg. Co.

FRIDAY, MAY 12

Final day's technical program, Friday, May 12, opened with a gray iron session at 10:00 a.m. Presiding were Fred J. Walls, International Nickel Co., Detroit, and G. A. Timmons, Climax Molybdenum Co.

"Correlation of Properties of Gray Iron" was described by Co-Authors R. G. McElwee, Vanadium Corp. of America, Detroit, and Richard Schneidewind, University of Michigan. Second paper of the session, *"Relaxation of Cast Iron,"* by V. T. Malcolm and S. Low of the Chapman Valve Co., Indian Orchard, Mass., described a means of determining the efficacy of stress relief in gray iron.

Steel session at 10:00 a.m. Friday, May 12, was under the chairmanship of L. H. Hahn, Sivyer Steel Casting Co., Chicago, and vice-chairmanship of J. K. McBroom, Stainless Foundry & Engineering Co.

First speaker of the session, Sam F. Carter, American Cast Iron Pipe Co., Birmingham, Ala., described an investigation of factors in *"Manganese Recovery in Acid Electric Steel Making."*

Second steel session paper was *"Metal Composition Tests for the Steel Melter,"* by H. H. Fairfield, H. F. Graham and A. E. McMeekin, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont., in which the authors claim that a satisfactory estimate of the composition of carbon steels can be made in less than two minutes by means of tests making use of hardenability properties.

Joint gray iron and malleable session, held at 2:00 p.m., Friday afternoon, May 12, had as its chairmen R. G. McElwee, Vanadium Corp. of America, Detroit, and V. A. Crosby, Climax Molybdenum Co., Detroit.

First paper presented at the session described *"Dilatometer Studies of Nodular Cast Iron,"* and was written by N. A. Ziegler, W. L. Meinhart and J. R. Goldsmith, all of Crane Co., Chicago.

Second paper of the joint session had as co-authors Gosta Vennerholm, Harold N. Bogart and Robert Melmoth, all of Ford Motor Co., Dearborn, Mich., and reported on *"Nodular Iron vs Section Size."*

Steel session at 2:00 p.m. was headed by J. A. Juppenlatz, Lebanon Steel Foundry, Lebanon, Pa.,

as chairman, with C. H. Lorig of Battelle Memorial Institute, Columbus, Ohio, as co-chairman.

First session paper was *"Fayalite Reaction in Sand Molds Used for Making Steel Castings,"* by Howard F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass., and R. E. Savage, International Nickel Co., New York. Defects caused by this interface phenomena are mechanical penetrations, cope defects, scabs, spalls and surface roughness.

Second of the session's papers was *"Relation of Thermal Gradients to the Soundness of Cast Steel Plates,"* by H. F. Bishop of the United States Naval Research Laboratory, Washington, D. C.

Tell Steel Research Progress

Concluding the steel session was presentation of a progress report on the work of the A.F.S. Steel Research Committee, presented by Committee Chairman Clyde Wyman, Burnside Steel Foundry Co.

Concluding five days of intensive technical sessions was a joint gray iron and steel session, held at 4:00 p.m. Friday, May 12, in the Ballroom of the Cleveland Public Auditorium. Session chairman was T. W. Curry, Lynchburg Foundry Co., and co-chairman was H. H. Kessler of Sorbo-Mat Process Engineers.

Session opened with the presentation of colored slides showing *"Principles of Risering,"* presented by C. F. Walton of the Case Institute of Technology, Cleveland. This was followed by *"Principles of Gating,"* by W. H. Johnson, W. O. Baker and W. S. Pellini of the United States Naval Research Laboratory, Washington, D. C.

Concluding the joint session and the entire technical program of the 54th A.F.S. Foundry Congress and Show was the showing of a motion picture, *"Finger Gating, Part II,"* by W. H. Johnson and W. O. Baker of the Naval Research Laboratory.

W. W. Levi, Lynchburg Foundry Co., Radford, Va., 1950 Hoyt Lecturer, receives gold watch from Gosta Vennerholm, Ford Motor Co., Dearborn, Mich., as token of appreciation for talk on cupola operation.

Annual Banquet photograph of the 54th Convention of the American Foundrymen's Society, Grand Ballroom, Hotel Statler, Cleveland, May 10, 1950. At the speakers' table are, standing, left to right. Technical Director S. C. Massari: Directors L. C. Farquhar, Sr.; F. G. Sefing; L. D. Wright; N. J. Dunbeck; Robert Gregg; Lt. Col. Earl D. Payne; Director E. N. Delahunt. Seated, left to right: Director J. M. Robb, Jr.; Past President F. J. Walls; Howard Taylor; Past Presidents Max Kuniansky and G. H. Clamer; Sven Torreson of Sweden; Past President Duncan Forbes; Lt. Col. F. H. Holmes; Vice-President-Elect W. L. Seelbach; Speaker Leonard Read; A.F.S. President Edwin Horlebein, N. P. Newman, IBF President; Vice-President Walton L. Woody; John L. Sissener of Norway; Gold Medal Recipients C. H. Lorig and Richard Schneidewind; Life Membership Recipients Clyde Frear and R. L. Lee; Past President W. B. Wallis; Directors F. C. Riecks, W. J. MacNeill, T. H. Benners, Jr., M. J. O'Brien, Jr., V. E. Zang; Secretary Emeritus R. E. Kennedy; Directors T. E. Egan, V. J. Sedlon; and Host Chapter Chairman Wm. G. Gude. Not shown is Sec.-Treas. Maloney.

SOCIETY ELECTS AND DIRECTORS

PRESIDENT
WALTON L. WOODY
National Malleable & Steel Castings Co.
Cleveland, Ohio

VICE-PRESIDENT
WALTER L. SEELBACH
Superior Foundry, Inc.
Cleveland, Ohio

DIRECTOR
FRANK W. SHIPLEY
Caterpillar Tractor Co.
Peoria, Ill.

DIRECTOR
JAMES THOMSON
Continental Foundry and Machine Co.
East Chicago, Ind.

HEADING THE ROSTER of 1950-51 National Officers and Directors of the American Foundrymen's Society, elected at the Annual Business Meeting of the Society during the 54th A.F.S. Foundry Congress & Show, Cleveland, May 10, is A.F.S. National President Walton L. Woody, vice-president, National Malleable & Steel Castings Co., Cleveland. Mr. Woody, who served as National Vice-President of A.F.S. for 1949-50, will take over the duties of 1949-50 President Edwin W. Horlebein at the annual meeting of the Society's Board of Directors this July.

Succeeding Mr. Woody to the vice-presidency of the Society is Walter L. Seelbach, president and general manager of Superior Foundry, Inc., Cleveland.

Elected to serve three-year terms as National Directors of the Society are:

J. J. McFadyen, general manager, Galt Malleable Iron Co., Galt, Ont., Canada.

J. O. Ostergren, president, Lakey Foundry & Machine Co., Muskegon, Mich.

Frank W. Shipley, foundry manager, Caterpillar Tractor Co., Peoria, Ill.

James Thomson, chief engineer, Continental Foundry & Machine Co., East Chicago, Ind.

E. C. Troy, foundry engineer, Palmyra, N. J.

Martin J. O'Brien, Jr., works manager, Symington-Gould Corp., Depew, N. Y., has been named to fill the unexpired term of the late Alfred M. Fulton of Northern Malleable Iron Co., St. Paul, Minn., who died February 15.

Edwin W. Horlebein, Gibson & Kirk Co., Baltimore, whose term as President of A.F.S. expires this year, will continue for one year as a National Director.

The newly-elected National Officers and Directors of A.F.S. all have long been prominent in both Chapter and National technical and administrative work.

Walton L. Woody

President-Elect Walton L. Woody has for many years played an important role in affairs of the American Foundrymen's Society, serving as a National Director (1943-45) and as National Vice-President (1949-50), as an active member of the Malleable Division, and as first chairman of the Northeastern Ohio Chapter.

A graduate in chemical engineering of Rose Polytechnic Institute, Mr. Woody has spent his entire foundry career as an employee of the National Malleable & Steel Castings Co., joining that organization as a student laboratory worker in 1914.

Since then he has served, successively, as chemist, metallurgist and melter, assistant superintendent, manager of the Chicago, Cleveland and Sharon, Pa., plants, and is today vice-president of National Malleable & Steel Castings Co.

Mr. Woody is a member of the National Foundry Association, the National Association of Manufacturers, the American Management Association, the Steel Founders' Society of America and the Malleable Founders' Society.

NEW OFFICERS AT CONVENTION

Walter L. Seelbach

A.F.S. National Vice-President Elect Walter L. Seelbach is a Past National Director of the American Foundrymen's Society (1935-37) and has served as president of the Ohio Foundrymen's Association (1926) and two terms as president of the Gray Iron Founders' Society (1943-44 and 1944-45).

A graduate of Case School of Applied Science in 1910, Mr. Seelbach joined Forest City Foundries Co., Cleveland, that year, subsequently becoming secretary-treasurer of that company, and at the time of his resignation in 1946 vice-president. Mr. Seelbach became head of his own company, Superior Foundry Co., Cleveland, in 1946.

In addition to the honors accorded him by the American Foundrymen's Society and the Gray Iron Founders' Society, Mr. Seelbach has been president of the Associated Industries of Cleveland, chairman of the Foundry Educational Foundation's Case Institute Advisory Committee and its Cleveland area campaign, and is chairman of the Sub-Committee on Gray Iron, Foundry Industry Committee to the Munitions Board of the National Military Establishment. He has for many years been active in foundry costs work with A.F.S.

J. J. McFadyen

Director-Elect J. J. McFadyen is general manager of the Galt Malleable Iron Co., Galt, Ont., Canada, the town where he was born and served his apprenticeship as a patternmaker with Babcock-Wilcox & Goldie-McCulloch, Ltd., in 1902. Joining Galt Malleable Iron Co. in 1908, he became general superintendent in 1916, and was appointed vice-president and general manager in 1947.

A member of the American Foundrymen's Society since 1917, Mr. McFadyen was instrumental in the formation of the A.F.S. Ontario Chapter, serving a term as chapter chairman. He has been a member of the A.F.S. Nominating Committee and several Malleable Division technical committees. Active in sports administration, particularly hockey and baseball, Mr. McFadyen is president of the Ontario Hockey Association, whose 42,000 members comprise one of the largest sports organizations in the world.

J. O. Ostergren

Director-Elect J. O. Ostergren, president and general manager of the Lakey Foundry and Machine Co., Muskegon, Mich., has during his foundry career risen from apprentice patternmaker and molder to the presidency of one of Michigan's largest foundries.

Beginning as an apprentice molder at Enterprise Brass Works, Muskegon Heights, Mich., around the turn of the century, Mr. Ostergren left after two years to become an apprentice patternmaker with Shaw Box Electric, Muskegon. After working in various Detroit pattern shops, he was put in charge of wood and metal patterns for the Holmes Machine Co., Sparta, Mich.,

DIRECTOR
E. C. TROY
Foundry Engineer
Palmyra, N. J.

DIRECTOR
J. J. McFADYEN
Galt Malleable Iron Co.
Galt, Ont., Canada

DIRECTOR
J. O. OSTERGREN
Lakey Foundry & Machine Co.
Muskegon, Mich.

DIRECTOR
EDWIN W. HORLEBEIN
Gibson & Kirk Co.
Baltimore, Md.

DIRECTOR

MARTIN J. O'BRIEN, JR.
Symington-Gould Corp.
Depew, N. Y.

and later the foundry at Dodge Bros., when the first Dodge automobile was built. After serving for a time as foreman of the Muskegon Pattern Works and supervisor of patterns for Continental Motors Corp., Mr. Ostergren became general manager of the Master Pattern Works, Muskegon.

Since 1922 he has been with Lakey Foundry & Machine Co., starting as superintendent of the pattern department and becoming, successively, foundry superintendent, vice-president, director, general manager, and in 1940, president of the company.

Mr. Ostergren was instrumental in the formation of the A.F.S. Western Michigan Chapter.

E. C. Troy

Director-Elect E. C. Troy, foundry engineer of Palmyra, N. J., has for several years been an active participant in A.F.S. technical committee work, has written for A.F.S. TRANSACTIONS and has been a frequent speaker at chapter and national meetings of the Society. A past chairman of the A.F.S. Philadelphia Chapter, Mr. Troy is a member of the A.F.S. Steel Division's Program and Papers Committee and the Heat Transfer Committee.

Born in Evansville, Ind., Mr. Troy attended technical high school there. In 1930, he was employed by the Detroit Steel Casting Co. as a laboratory assistant, and two years later entered the Michigan College of Mining and Technology, graduating in 1935 with honors in metallurgy and a bachelor of science degree. Upon graduation he returned to Detroit Steel Casting Co. as a metallurgist, leaving there to join Dodge Steel Co., Philadelphia, as metallurgist in 1937. At the time of his resignation from Dodge in 1948 to form his own foundry engineering firm, Mr. Troy was vice-president in charge of research and development.

Frank W. Shipley

Director-Elect Frank W. Shipley, foundry manager, Caterpillar Tractor Co., Peoria, Ill., is Immediate Past Chairman of the A.F.S. Central Illinois Chapter and a member of the A.F.S. Essay Contest Committee, the Educational Division's Textbook Committee and the A.F.S. By-Laws Committee.

Born in Disko, Ind., Mr. Shipley attended Purdue University, graduating in 1921 with a degree in chemical engineering. Beginning as a chemist with Studebaker Corp., South Bend, Ind., that same year, he became successively, foundry metallurgist for Studebaker and for Lakey Foundry & Machine Co., Muskegon, Mich., and chief foundry metallurgist for Fairbanks, Morse Co., Beloit, Wis.

In 1929 Mr. Shipley joined Caterpillar Tractor Co. as chief foundry metallurgist, becoming foundry superintendent in 1942 and foundry manager in 1944.

James Thomson

Director-Elect James Thomson, chief works engineer for Continental Foundry & Machine Co., East Chicago, Ind., is a past chairman of the A.F.S. Chicago Chapter and is chairman of the A.F.S. Plant & Plant Equipment Committee. He has been active on many A.F.S. technical committees in the past.

A native of Scotland, Mr. Thomson attended grade and high schools in Pittsburgh and attended Washington and Jefferson College. After serving an apprenticeship as a wood and photo engraver, he held positions as draftsman with several Pittsburgh metals and engineering firms, prior to becoming plant engineer for United Engineering and Foundry Co., Pittsburgh, from 1906 to 1916. He has been chief works engineer for Continental Foundry & Machine Co. since 1916.

Martin J. O'Brien, Jr.

Named to fill the unexpired term of the late Alfred M. Fulton of Northern Malleable Iron Co., St. Paul, Martin J. O'Brien, Jr., works manager, Symington-Gould Corp., Depew, N. Y., is a past chairman of the A.F.S. Western New York Chapter.

Born in St. Louis, Mr. O'Brien attended high school in that city, and took mechanical engineering courses through International Correspondence Schools, prior to joining American Steel Foundries, East St. Louis, Ill., as a laboratory assistant, later becoming an apprentice at the company's Granite City, Ill., plant. He resigned to join Symington-Gould Corp. as a special apprentice, becoming, successively, assistant foreman, assistant superintendent, superintendent, assistant works manager, and, since last year, works manager.

Edwin W. Horlebein

A.F.S. National President Edwin W. Horlebein, president, Gibson & Kirk Co., Baltimore, in accordance with A.F.S. by-laws, serves a one-year term as a National Director of the Society upon completion of his term.

Mr. Horlebein's service to the American Foundrymen's Society has been long and distinguished. He was the first chairman of the A.F.S. Chesapeake Chapter, is a past National Director of the Society (1945-48) and past A.F.S. National Vice-President (1948-49).

Wartime chairman of the OPA Brass and Bronze National Advisory Committee, Mr. Horlebein is chairman of the Munitions Board's Foundry Sub-Committee on Brass and Bronze Castings and a member of the Munitions Board Committees on Copper and Copper-Base Alloys and Foundry Advisory Committee. He is a member of the Executive Committee of the A.F.S. Brass and Bronze Division and a past president of the Non-Ferrous Founders' Society.

A native of Baltimore, Mr. Horlebein received his schooling in that city and served an apprenticeship in the machine shops of the Baltimore & Ohio Railroad. Upon discharge as a Lieutenant of Field Artillery in World War I, he was appointed engineer for the Dixie Manufacturing Co., Baltimore, and in 1924 was named president of the Gibson & Kirk Co., Baltimore.

METALLURGICAL OXYGEN SPEEDS FOUNDRY OPEN HEARTH MELTING

L. L. Whitney
Supt., Melted Metals
American Steel Foundries
Alliance, Ohio

IT MAY BE ASSUMED that the initial phase in the use of metallurgical oxygen has passed; along with this, the novelty has worn off. Some shops formerly employing oxygen have discontinued its use altogether; others have substituted compressed air wholly or partially, or limited the use of oxygen to specific types of heats. Contrary to this, electric furnace shops producing high-alloy steels find its use advantageous and their oxygen consumption has increased.

The author's plant has continued the experimental use of metallurgical oxygen both as a melting agent and carbon remover. Oxygen was used in conjunction with fuel oil by directing it onto a pile of preheated scrap. The type of burner employed was a single passage suplying a high velocity oxygen stream below the oil burner. The head of the burner was fitted with a replaceable nozzle designed to furnish supersonic oxygen velocities by means of a venturi effect. The result was an approximate decrease of 20 per cent in the melt time over normal methods.

Melt Time Reduced

To supplement oxygen added to the furnace gases, a dual burner was installed which further reduced the melt time. The fuel oil-oxygen flame was kept skimming over the top of the preheated charge. By reducing the forced air the scrap charge was quickly melted, with a slight benefit in refractory life since the heat input was almost entirely absorbed by the charge.

Operating for a 3-mo period the following average results were obtained with a 61,000-lb charge: heat time (charge to tap), 3 hr, 57 min; fuel oil consumption, 26.6 gal per ton; oxygen consumption, 450 cu ft per ton.

In a brief summary for the so-called initial phase, employing oxygen in conjunction with fuel oil, the following results are tabulated:

1. A more rapid melting rate was obtained.
2. By means of a dual burner, additional Btu input decreased melting times.
3. Melting costs were decreased.
4. Checker temperatures were increased, and steam in the waste heat boiler was increased 75 per cent.
5. Refractory costs were slightly decreased.
6. Heats melted hotter.
7. No detrimetal metallurgical effects were observed.

A ½-in. lance was employed only partially to reduce carbon in the bath. Since a tap carbon of 0.30 per cent with about a 25 point working range was standard practice, splash of viscous slags was detrimental to roof life. The action of injected oxygen caused a definite temperature rise, resulting in dense, voluminous fumes composed largely of Fe_2O_3. Along with the splash, these hot fumes caused over-all erosion of the silica roof.

Since completion of the experimental stage in the use of metallurgical oxygen, a number of new melting factors have arisen at this plant:

1. The scrap situation has deteriorated to the extent that 80 per cent more charging pans are required, charging times increasing proportionally.
2. Increased production made it desirable to use oxygen on two furnaces instead of one. This demand exceeded the capacity of the oxygen unit, and caused delays while changes were being made.
3. The plant entered production of low carbon conversion ingots, with a great need for lancing.
4. Production increase necessitated training new personnel.

This combination of factors resulted in an increase in heat times over previous runs. In an attempt to

Left—Erosion at back skew back of open hearth furnace after 262 heats; ten courses of super duty silica brick were used on the back shoulder from knuckle to knuckle. Above—Erosion at front skew back of the same furnace; seven courses of super duty silica brick were laid from knuckle to knuckle in the construction.

The oxygen lance in operation (right) creates little turbulence and no splash in the open hearth furnace bath (below).

offset these factors, the oxygen line was increased and burner oxygen was introduced immediately after the lime charge. Thus the practice was changed from directing oxygen onto preheated scrap to introducing it during the charging period in an effort to shorten the meltdown.

Due to alloy restrictions a large number of heats employed a charge of almost 70 per cent No. 1 bundles and no pig iron. Such combinations resulted in a split flame, and the hot fuel-oxygen flame contacting both skew back channels caused excessive erosion at these points. In some cases roof life was reduced 40 per cent. To offset this a super duty silica brick was employed from knuckle to knuckle for ten roof courses on the back skew back, and seven courses on the front skew back.

A change in charging methods was made wherein the charging operation was completed in two to three cuts while attempting to maintain a skimming rather than a direct impingement flame on the scrap pile. Here again the charging time was increased and oxygen efficiency decreased. The following results were obtained:

Heat Times	Fuel Oil Consumption	Oxygen Consumption
0.30 C aim, 4 hr 41 min	29.1 gal/ton	850 cu ft
0.08 C max., 4 hr 59 min	30.0 gal/ton	975 cu ft

The average heat-time savings in 0.30 per cent carbon heats using oxygen in conjunction with fuel oil was reduced to approximately 13 per cent. However, the actual number of minutes saved per heat remained the same (50-55 min) as tabulated during oxygen line failures where heats were produced without benefit of oxygen.

The guiding factor in the use of oxygen in conjunction with fuel oil is the type of scrap charge and the method of introducing it into the furnace. A preferred charge will halve the oxygen consumption since the charge may be preheated. As the weight per cubic foot of scrap charge decreases charging times are increased to the point where oxyen must be directed onto a cold pile of scrap; its efficiency is greatly reduced and refractory wear results. The plant must then decide whether the production increase is sufficient to warrant the excess refractory wear, along with the cost of oxygen.

In contrast to the undesirable conditions imposed by the scrap situation, oxygen used as a decarburizer has become a more desirable tool through improved methods and techniques. Its adaptability to both foundry and low-carbon rimmed steels as compared to compressed air greatly enhances its use in cold metal shops.

In foundry heats with an aim of 0.30 per cent carbon, it would be desirable to melt as high as economically feasible in order to maintain a fast meltdown. In so doing the refining time is reduced over normal conditions since carbon removal by oxygen injection into the bath is fast enough, and the exothermic reaction produced is sufficient to shape up the metal by the time the tap carbon is reached.

With compressed air the carbon drop would compare favorably to that caused by oxygen, but any temperature pickup would be obtained mostly through turbulence and might not be high enough when the tap carbon is reached.

Injected oxygen is of greater importance with low-carbon rimmed steels. Here, too, it would be desirable to melt as high as possible due to accelerated meltdown and reduce the carbon rapidly with oxygen, or perhaps compressed air. It has been shown that compressed air and oxygen will remove carbon at about the same rate until 0.25 per cent carbon is reached. From this point on, oxygen is increasingly faster.

It has been pointed out that undesirable splash and fumes are encountered with injected oxygen. Greater

TABLE 1—OPERATING EFFICIENCIES OF SINGLE AND MULTIPLE OXYGEN LANCES

	Type Heat	Melted at % C	Reduced to % C	Tap % C	Oxygen Time, min	Oxygen Consumption, cu ft	O_2 ft/ton
½-in. pipe	} Cstg	0.70	0.40	0.31	8	1500	1.56
	} Rim	0.45	0.05	0.05	22	3500	3.64
Permanent	} Cstg	1.08	0.45	0.31	13	2600	1.35
Lance	} Rim	0.75	0.05	0.05	35	5140	2.47

splash is obtained with more viscous slags and may be eliminated by: (1) employing iron ore along with the lance to break up the slag; and (2) using a multiple opening, water cooled permanent lance in conjunction with iron ore at high carbons. The latter method has been recently installed and is preferable since after the initial cost of the equipment is amortized no further expense is entailed except the cost of oxygen.

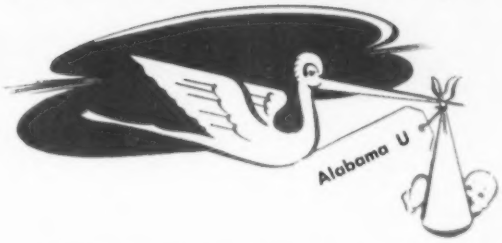
The multiple opening, water cooled lance has shown a 10 per cent production increase over previous lancing methods when used in low-carbon rimmed heats. This increase is attributed to more efficient and greater oxygen input. At the 1948 National Open Hearth Meeting, H. E. Warren ably demonstrated by means of motion picture film the degree of splash obtained in water and glycerine by a single-opening lance as compared to that of a multiple-opening lance.

The single opening produced a greater turbulence for the same liquid viscosity than did a multiple opening, and this holds true for the practical application. The gas from the multiple opening has a much better chance of permeating the metal, which is largely responsible for the increased working efficiency.

In Table 1 a comparison is made of the efficiencies of single-and multiple-opening oxygen lances employed on 64,000-lb charges.

In summary, injected oxygen when properly handled is a valuable production tool. Bottom delays have been reduced; refining times have been further reduced by means of the permanent lance; and excess refractory wear has been largely decreased.

Students at University of Alabama Start Ninth A.F.S. Student Chapter



PETITION TO ORGANIZE a student chapter of A.F.S. at the University of Alabama followed by less than a week the installation of the Michigan State College Chapter April 5 (see page 71). Unanimous approval by the Board of Directors of the Society paves the way for the establishment of the ninth student chapter.

Leader in organizing the new student chapter is Warren C. Jeffery, University of Alabama foundry instructor. A faculty adviser from the university and an industrial adviser from the Birmingham District Chapter are expected to be appointed soon.

Students who signed the petition for recognition as an A.F.S. student chapter are: Byron E. Kennel, Dwight E. McGill, Nathan R. Koenig, Anthony J. McAndrews, and Aaron S. Glidewell – all members of A.F.S. prior to the petition.

Applications for membership accompanying the petition came from: Robert E. Jennings, S. G. Holder, Jr., Thomas J. Price, Paul E. Hegmegee, Jr., Jack R. Pollard, A. E. Fitzgerald, Joseph C. Graden, Carlos J. Romero, Martin W. Schmutz, and Eugene E. Langner, Jr.

The University of Alabama started operations in its new foundry with a special inaugural heat January 31, celebrating the culmination of efforts of Southern foundrymen and the university to secure equipment and facilities valued at $70,000.

Plan Salesmanship Course for Engineers, Technical Men

Sealing bond of cooperation between industry and education in establishment of salesmanship training courses for engineers are (shaking hands), left, D. F. Lane of Lever Bros., (center) Dr. R. A. Love of City College School of Business, where courses will be held, and Lloyd Wasson of York Distributors. In background are, left, A. K. Mitchell of Western Union, and G. F. Sullivan of Iron Age. *Mr. Lane is author of A.F.S.'s recently published manual,* GUIDE TO FOREMAN TRAINING CONFERENCES.

APPRENTICE CONTEST

TOP DIVISIONAL AWARDS

JOHN W. BURKHOLDER, JR.
1st, METAL PATTERNMAKING

RICHARD BOWMAN
1st, GRAY IRON MOLDING

Fifteen foundry apprentices, thirteen from the United States and two from Canada, were victors over 259 contestants in the 27th Annual A.F.S. Apprentice Contest, judged April 8 at the Cleveland Trade School, Cleveland, Ohio.

Winners in this year's five contest divisions—Gray Iron Molding, Steel Molding, Non-Ferrous Molding and Wood Patternmaking and Metal Patternmaking (new this year) are mostly World War II veterans, with seven of them having seen service with the Navy, two with the Army and one with the Coast Guard.

First prize winners in their respective contest divisions are: *Gray Iron Molding*, Richard Bowman, American Car & Foundry Co., St. Louis; *Steel Molding*, Richard C. Tracy, Dominion Engineering Works, Ltd., Montreal, Que., Canada; *Non-Ferrous Molding*, Worth Cropp, Jr., Pacific Brass Foundry, San Francisco; *Wood Patternmaking*, Eugene W. Chmielowicz, Motor Patterns Co., Cleveland; and *Metal Patternmaking*, John W. Burkholder, Jr., Central Pattern Co., St. Louis, Mo., who won first place in the Wood Patternmaking Division of the 1949 contest.

These five divisional contest winners were guests of the American Foundrymen's Society at the 54th A.F.S. Foundry Congress & Show, May 8-12, in Cleveland, where they were each awarded $100 prizes and certificates by A.F.S. National President Edwin W. Horlebein at the Annual Business Meeting of the Society held Wednesday afternoon, May 10.

Second prize winners in each of the five contest divisions, who received $50 prizes at appropriate plant or A.F.S. Chapter ceremonies, are:

Gray Iron Molding, Ernest E. Grenier, Builders Iron Foundry Co., Providence, R. I.; Steel Molding, Guy Belanger, Dominion Engineering Works, Ltd., Montreal, Que., Canada; *Non-Ferrous Molding*, Anthony J. Masiakowski, Nordberg Mfg. Co., Milwaukee; *Wood Patternmaking*, James A. Orban, Royal Pattern Works Co., Cleveland; and *Metal Patternmaking*, James V. Gaino, also of Royal Pattern Works Co., Cleveland.

Winners of $25 third place prizes are: *Gray Iron Molding*, Taisto Pethman, General Metals Corp., Oakland, Calif.; *Steel Molding*, Norman G. Bublitz, Bucyrus-Erie Co., South Milwaukee, Wis.; *Non-Ferrous Molding*, Victor J. Gadzalinski, Nordberg Mfg. Co., Milwaukee; *Wood Patternmaking*, Donald A. Siebert, Royal Pattern Works Co., Cleveland (Winner of second place in Wood Patternmaking in last year's contest); and *Metal Patternmaking*, John F. Banach, City Pattern and Foundry Co., South Bend, Ind.

Richard Bowman of American Car & Foundry Co., St. Louis, this year's first prize winner in Gray Iron Molding, has completed three-and-one half years of his apprenticeship. Born in Holcomb, Mo., in 1925, Bowman joined Bachmann Machine Co., St. Louis, in 1942, serving as an apprentice machinist until his induction into the Army in 1943. Awarded the Purple Heart and several campaign stars while serving as a corporal overseas with the Infantry, he entered the

Cleveland area judges and A.F.S. officials who took part in National Judging of the 27th A.F.S. Apprentice Contest, April 8, are, front row, left to right: A.F.S. National Director V. J. Sedlon, Master Pattern Co.; A.F.S. Technical Assistant Jos. E. Foster; A.F.S. Apprentice Contest Chairman R. W. Schroeder, University of Illinois; James Goldie, M.B.M. Foundry, Inc.; Louis Klein, Crucible Steel Casting Co.; Wilbur Thomas, Bowler Foundry Co., and Frank Cech, Cleve-

WINNERS ANNOUNCED
MADE AT CONVENTION

RICHARD C. TRACY
1st, STEEL MOLDING

WORTH CROPP, JR.
1st, NON-FERROUS MOLDING

EUGENE W. CHMIELOWICZ
1st, WOOD PATTERNMAKING

foundry as an apprentice molder upon discharge from the Army in 1946, because, in his own words, "I feel that I can exercise my creative ability and earn a good living in the foundry industry."

Second prize winner in Gray Iron Molding, Ernest E. Grenier, Builders Iron Foundry, Providence, R. I., was born in Fall River, Mass., in 1926. He interrupted his schooling at LaSalle Academy to become an Aviation Machinist's Mate in the Navy and saw service in both the Atlantic and Pacific theaters. Graduating from LaSalle Academy in 1946, he joined Browne & Sharpe Mfg. Co., Providence, as an apprentice molder that year and is now completing his apprenticeship with Builders Iron Foundry.

Taisto Pethman, third place winner in Gray Iron Molding, was born in Finland in 1929, but attended grade and high school in Daly City, Calif. From June, 1946, to May, 1949, he was apprenticed to Enterprise Engine & Foundry Co., San Francisco, and has since been with General Metals Corp.

Richard C. Tracy, first prize winner in Steel Molding, is in his fourth year as an apprentice with Dominion Engineering Works, Ltd., Montreal, Que., Canada. Born in Lachine, Que., in 1930, Tracy attended grade and high school in Montreal. He began training in all branches of iron, bronze and steel foundry practice with Dominion Engineering in 1946. He is the winner of several trophies for model aircraft flights and is model aircraft group leader and scout leader for his district.

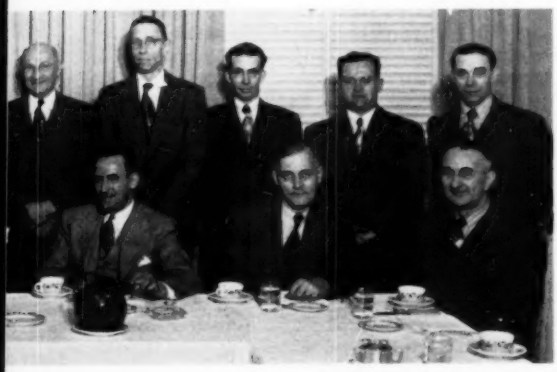
Second prize winner in Steel Molding, Guy Belanger, is also in his fourth year as an apprentice with Dominion Engineering Works, Ltd., Montreal, Que., Canada, and like First Prize Winner Tracy, joined Dominion Engineering in 1946 for training in all branches of the foundry industry.

Norman G. Bublitz, awarded third place in Steel Molding, is with Bucyrus-Erie Corp., South Milwaukee, Wis. Born in nearby Cudahy, Wis., he attended school in South Milwaukee, joining Bucyrus-Erie as an apprentice shortly after his 16th birthday.

Worth Cropp, Jr., first place winner in Non-Ferrous Molding, is in his fourth year as an apprentice molder with Pacific Brass Foundry, San Francisco. Born February 3, 1923, in Connelsville, Pa., Cropp attended grade and high school there, later attending the Berkeley, Calif., Trade School, after serving for three years as a Navy Boatswain's Mate in the Pacific. He has been with Pacific Brass Foundry since his discharge from the Service in 1946.

Second place winner, Non-Ferrous Molding Division, Anthony J. Masiakowski, has completed more than 5,000 hours of an 8,320 hour apprenticeship with Nordberg Mfg. Co., Milwaukee. Born in Milwaukee in 1927, Masiakowski attended classes in molding at Milwaukee Vocational School. Employed as a mechanic's helper with Doering Motors, Milwaukee, he joined Nordberg Mfg. Co. as a molder's helper in 1947. After discussion with his supervisor, Masiakowski decided the best way in which to become an all-round

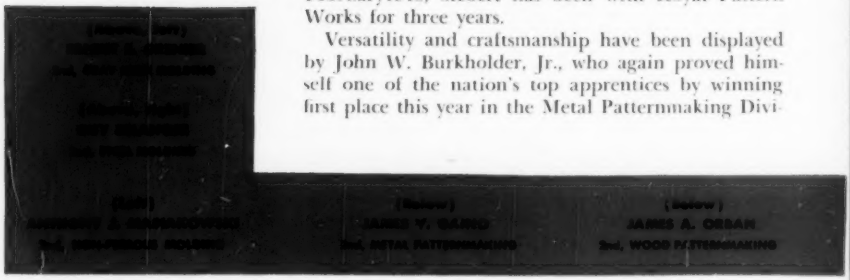
land Trade School. Standing, left to right: Carl Winkler, Cleveland Standard Pattern Works; Louis Schmidt, Aluminum Co. of America; Herbert Waterfall, John W. Wilbur Co.; Al Hinton, Aluminum Co. of America; Peter Rettig, Rettig Pattern Co.; Michael Dolan, Motor Patterns Co.; Charles Wilberscheid, Master Pattern Co.; John Jasso, Wellman Bronze & Aluminum Co., and Anthony Sutowski of the Cleveland Trade School, where contest entries were judged.



band and member of a church basketball team. Hobbies: Model Plane building (since he was seven years old), furniture making, cartooning, water color painting, magic.

A two-time National Contest winner is Donald A. Siebert, also of Royal Pattern Works Co. Siebert placed second in Wood Patternmaking in the 1949 contest and third this year. Born February 24 in Cleveland, he attended West Technical High School in that city and is currently a student at Cleveland College. A veteran of Coast Guard, where he served as an Electronic Technician's Mate from February, 1946, to February1948, Siebert has been with Royal Pattern Works for three years.

Versatility and craftsmanship have been displayed by John W. Burkholder, Jr., who again proved himself one of the nation's top apprentices by winning first place this year in the Metal Patternmaking Divi-



foundryman was to become an apprentice, which he did after two months as a helper.

Victor J. Gadzalinski, like Second Prize winner Masiakowski, has completed some 5,000 hours of an 8,320 hour apprenticeship with Nordberg Mfg. Co., Milwaukee. Winner of third place in Non-Ferrous Molding, Gadzalinski is also a graduate of molding courses at Milwaukee Vocational School. After serving overseas as a Seaman 1st Class in the Navy Amphibious Corps from 1944 to 1946, he joined Nordberg in January of 1948 as an apprentice molder, following in the footsteps of his father, an expert molder who died when Gadzalinski was six years old.

Eugene Chmielowicz, Motor Patterns Co., Cleveland, first place winner in Wood Patternmaking, was born December 11, 1926 in Cleveland, where he attended grade school, high school and the Cleveland Trade School. After a few months spent as tool room and maintenance man with Master Pattern Co., Cleveland, and as bobbin boy with the Cleveland Worsted Mills, Chmielowicz joined Motor Patterns Co. as an apprentice in 1944. His apprenticeship was interrupted by service with the Seabees from December, 1944, to July, 1946, when he rejoined Motor Patterns.

James A. Orban, winner of second place in Wood Patternmaking, is with Royal Pattern Works Co., Cleveland. Born June 17, 1928, in Cleveland, Orban attended grade and high school there and is a student at Cleveland Trade School, where he has won honors as outstanding student in foundry and patternmaking. Starting his apprenticeship with Royal Pattern Works in January, 1946, his training was broken by 18 months spent as an Army corporal with occupation troops in Japan. Returning in April of 1948, he resumed his apprentice training. A man of many activities and hobbies, Orban is vice-president of the Cleveland Baptist Young People, vice-president of the Ohio Hungarian Baptist Young People, bass tuba player in a

sion, open for the first time. Burkholder was first place winner in Wood Patternmaking in the National Contest last year; third place winner in the St. Louis District Chapter's 1948 Apprentice Contest; first place in Wood Patternmaking in both this year's and last year's Chapter contest. Texas born, Burkholder attended grade and high school in St. Louis, the Hadley Vocational School, St. Louis, for three years, and the David Ranken, Jr., School of Mechanical Trades, St. Louis, for one year. In June, 1946, Burkholder, one week out of the Navy, where he had served for two years, came to meet his father, for 13 years a foundryman with Central Pattern Co., and accompany him home from work. His father introduced him around the plant and asked if there would be an opening for his son as a wood patternmaker in the organization. Told that a metal patternmaking apprenticeship would materialize shortly, Burkholder was put to work at wood shellacking for a year, and on July 1, 1947, became a metal patternmaking apprentice. Since, until this year, there was no National Contest Metal Patternmaking Division, Burkholder entered the Wood Patternmaking Contest, winning top honors in both St. Louis Chapter and the National Contest.

James V. Gaino, second place winner in Metal Patternmaking, is one of three Royal Pattern Works Co., Cleveland, to win top honors in Wood and Metal Patternmaking in this year's National Contest. Born October 16, 1924, in Cleveland, he is a graduate of Cleveland's Lawn grade school and West Technical High School. Gaino saw service as a Signalman Third Class with the Navy from March 10, 1943, to February 4, 1946, and shortly afterwards joined Royal Pattern as an apprentice metal patternmaker.

John F. Banach, third place winner in Metal Patternmaking, has completed three years and nine months of his apprenticeship in metal patternmaking at City Pattern & Foundry Co., Inc., South Bend, Ind. Born May 19, 1923, in South Bend, he is a graduate of South Bend's Central High School, and saw service as a Signalman Second Class with the Navy from 1942 to 1945. He is a member of the Pattern Makers League of North America, South Bend Chapter.

Number of entries in respective Divisions of the 27th A.F.S. National Apprentice Contest were: Gray Iron Molding, 74; Steel Molding, 20; Non-Ferrous Molding, 17; Wood Patternmaking, 109; and Metal Patternmaking, 39, making a total of 259 entries.

Ten A.F.S. Chapters held local apprentice contests in preparation for the National Judging in Cleveland, April 8—Northern California, Southern California, St. Louis District, Detroit, Wisconsin, No. Illinois-So. Wisconsin, Michiana, Ontario, and Eastern Canada.

Chairman of the Apprentice Contest Committees of the various participating chapters are: Northern California, W. S. Gibbons, Ridge Foundry, San Leandro, Calif.; Southern California, R. J. Wallace, Westlectric Steel Castings, Inc., East Los Angeles, Calif.; St. Louis District, F. W. Burgdorfer, Missouri Pattern Works, St. Louis; Detroit, W. E. Kidwell, Packard Motor Car Co, Detroit; Wisconsin, Andrew A. Bottoni, Milwaukee Vocational School; Northern Illinois-Southern Wisconsin, Lyle W. Fulton, Geo. D. Roper Corp., Rockford, Ill.; Michiana, George E. Garvey, City Pattern & Foundry Co., South Bend, Ind.; Northeastern Ohio, Frank C. Cech, Cleveland Trade School (Molding) and Anthony Sutowski, Cleveland Trade School (Patternmaking); Eastern Canada, G. Ewing Tait, Dominon Engineering Works, Ltd., Montreal, and W. Turney Shute, Canadian Car & Foundry Co., Montreal. Mr. Tait acted as coordinator for both the Eastern Canada and Ontario Chapter contests, expediting patterns and entries through customs, etc.

Some 77 plants participated in chapter contests, while 21 others held their own in-plant contests.

Headed by Roy W. Schroeder, Navy Pier Branch, University of Illinois, Chicago, the A.F.S. Apprentice Contest Committee has been responsible for making and correlating arrangements for the 1950 A.F.S. Apprentice Contest. Members are: F. W. Burgdorfer, Missouri Pattern Works, St. Louis; C. W. Morisett, Pennsylvania State College; J. A. Haven, Liquid Carbonic Co., Chicago; G. E. Garvey, City Pattern & Foundry Co., South Bend, Ind.; A. C. Gocher, Fletcher Works, Inc, Philadelphia; E. J. McAfee, Puget Sound Naval Shipyard, Bremerton, Wash.; Vaughan C. Reid, City Pattern Foundry & Machine Co., Detroit; and G. Ewing Tait, Dominion Engineering Works, Ltd., Montreal.

After the Committee selected the 1950 Contest casting, F. W. Burgdorfer, Missouri Pattern Co., St. Louis, made a master pattern from which 12 duplicate aluminum patterns were made by George E. Garvey, City Pattern & Foundry Co., South Bend, Ind., and returned to Mr. Burgdorfer for finishing. Mr. Garvey also made 56 rough castings for the Metal Pattern Division. Boxes for shipping molding divisions patterns were made by McCormick Works, International Harvester Co., Chicago, and by Pettibone Mulliken Corp., Chicago, courtesy of C. V. Nass, vice-president.

National Judging took place April 8 at the Cleveland Trade School, whose premises were made available through courtesy of Principal D. C. Courtwright. Frank Cech, Cleveland Trade School, received and stored entries for judging.

(Above)
TAISTO PETHMAN
2nd, GRAY IRON MOLDING

(Above)
NORMAN G. BUBLITZ
2nd, STEEL MOLDING

(Right)
VICTOR J. GADZALINSKI
2nd, NON-FERROUS MOLDING

(Below, left)
DONALD L. SIEBERT
2nd, WOOD PATTERNMAKING

(Below, right)
JOHN F. BANACH
3rd, METAL PATTERNMAKING

NON-FERROUS FOUNDRY PRACTICE

C. A. Robeck
Vice-President
Gibson & Kirk Co.
Baltimore, Md.

GOOD FOUNDRY PRACTICE evolves from sweat and tears. Whether these practices are derived from precisely-formulated written instructions or from rules-of-thumb, there is one yardstick by which they can be measured—if they produce good castings they are good practices. Granting that these practices often vary to the point of contradiction and confusion, certain fundamentals apply to all.

First, records must be kept and used. These records do not have to be complex and burdensome. They should present a graphic story of casting problems and their solution. Their simplicity and brevity should be an index of the thought put into them.

Four Sources of Records

Records should be compiled from four sources—(1) Melting Department, (2) Molding Department, (3) Core Shop, and (4) Cleaning Department.

In considering records from the melting department, we should also consider the reception and handling of raw materials coming into this department. Fuels as well as melting supplies and metals are important factors in determining practice. For instance, if fuel oil is used, it should be bought to a specification. Viscosity, heat content per unit volume, sulphur content, flash and end points established, and a routine check in your own laboratory or at an independent laboratory two or four times per year will be well worth the expense. On receiving oils, a clerk should check the height of oil in truck or tank car compartments. Make sure that the supplier standardizes his load volumetrically to 70F, particularly if the oil has been stored above ground in the summer.

Daily Records Indicate Trends

Elementary figures on melting and supply costs are easily obtained. A daily record of the number of heats per furnace can be kept, as well as a daily tally of the total metal melted. At the same time, entries can be made to account for expenditures of such supplies as crucibles, refractories, etc. A daily record of fuel consumption by plumbing the tanks, reading the meters, etc., will give a quick indication of the daily trends.

The final item in the matter of raw materials concerns purchased metal. Whether you purchase scrap, ingot or virgin, a basic specification should be set up. If your supplier furnishes you with an analysis, spot check him by periodic laboratory cross checks. Restrict purchasing, if possible, to one source for a particular alloy and develop practice about that grade of material. It is possible to purchase alloys to commercial or government specifications where the range in allowable analyses may be so great as to give non-conforming results in physical testing of test coupons, even though your standard practice is maintained.

By all means purchase and use a suitable scale to weigh all incoming metal. Where possible, count ingots as a cross check. Where metal moves in by one or several means of transportation, all incoming metal should be weighed with the deliverer witnessing the act. Notations of shortage or overage should be marked on the shipping papers and acknowledged by the deliverer. A good scale is a good employee and investment.

Adequate storage and bin space should be provided to segregate raw metal. Substantial containers, in good repair, for the transportation of metal from storage to melting furnaces should be available. A similar method for transportation of back scrap from cleaning department to metal storage is a necessity.

Identification of Metal Necessary

The safest way to prevent contamination and mixture of alloys is to keep all metal off the floor and in marked containers or in storage bins. Back scrap from the cleaning department may be identifiable by comparison of "cast on" numbers or other identification marks on gates and risers. Metal with no such identification, if left on the floor soon loses its identity and becomes a potential source of trouble if it contaminates other metals. This is true of spills and runouts and also of broken sprues and flashes and fins at shakeouts. These metals become a hazard or at least a partial loss if they lose their identity. Minimize this loss by acting promptly and removing them immediately to storage.

Granting that the ideal will never be entirely attained, it is wise to be realistic and consider the operation of a salvage department. The amount of labor required to operate this department will tell how well and efficiently plant house-keeping is working.

In departmentalizing this job, assign one man for any part of a day or as many men full time as may be required. In general, this department will take care of segregating and sorting all metal not readily indentifiable. This will include sweepings, spillings, fins and flashes from core shakeout in the foundry, as well as reclamation metal from slag crushers.

All unidentifiable back scrap returns from the clean-

ing department will also be handled here. Work done in this department, consistent with minimum difficulty in maintaining quality of remelted backscrap and a minimum amount of tollage turned back to the smelters, will be an index to efficient housekeeping in the non-ferrous foundry.

A few simple rules, well enforced, will assist in these operations:

(1) Police poured off floors promptly and remove the spilled metal to save sorting later.

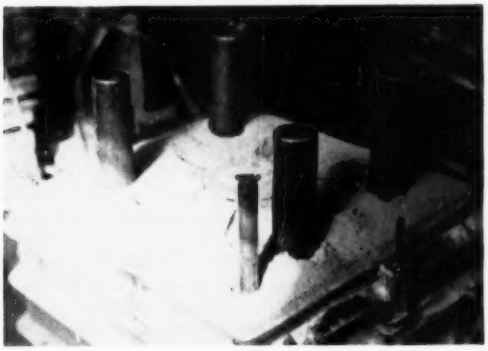
(2) Segregate skimmings according to major alloy classifications. They are worth more that way whether you sell them or reclaim them.

(3) Continually and carefully sort metal for salvage. Do not let it accumulate.

(4) Return this metal to the melting room for immediate remelt to reduce losses in handling and to save labor required if the metal is to be stored.

(5) Review the results of your salvage operations to determine if they are saving or costing money. These operations may become so involved that they are no longer economical.

In the melting room proper there are several sets of records to be kept which encourage the observation of good foundry practice. There are also certain instruc-



Set risers and down sprues before placing cope. Set runners and down sprues are already rammed in drag.

tions which, if available, assist furnace operators. Lack of these minimum requirements can cause chaos, promote interminable argument and end in complete frustration. The rules of the game should promote teamwork and cooperation and should help him to take pride in his work.

Furnace operators should be supplied with a daily work sheet listing work to be produced on each molder's floor. This listing should give the customer's name, pattern number, alloy and temperature at which metal is to be poured. This basic information will allow the furnace operator to plan his day's work. It should be the duty of the operator to survey the production on each floor and to determine when and how the melting and pour-off will take place.

The second set of records should be kept within the melting room and should be proof that this department is operating in conformity with good practice. There are three elementary instruments which can record or indicate these facts. They are a weigh scale, a clock (job recording type preferred), and a pyrometer (recording type preferred).

Each heat melted during the day should be reported. The melt report is kept separately for each heat and should show date, location of the furnace in which heat is being melted and identification of the particular heat, i.e., whether it is the first, second, third or fourth heat withdrawn from that furnace that day.

The report should show the alloy being melted and the weights of components of the charge. If ingot is used, indicate proportioning of ingots to remelt back scrap. Weigh scales will produce these figures. From daily operations it will be found that furnaces may be operated accurately by observing a timed cycle.

Repetitious Melt Checks Eliminated

If such a system is established, furnace operators are freed of repetitious checking of melt during the final period of superheat. Thus, by stamping the melt ticket in the job clock when the flame is turned on in the furnace, the operator can by experience predict within several minutes when the last solid metal will go under the surface of the melt. He can so mark his melt ticket in pencil in a space marked "metal melted" and go about his business with other furnaces, returning to recheck that melt within the time marked. When he has determined that the last solid metal in the melt has become liquid, he should stamp the time by the job clock over the pencilled time and mark in pencil in the "stopped" column the predicted time when the heat will be up to the temperature that is specified on the daily furnace room work sheet.

Melt Tickets Show Equipment Condition

Again he may go about his business to return at a time when desired temperature will be reached. When this moment arrives, he will stamp the time on the melt ticket to indicate when the flame was turned off. The variation of time for melting as shown on these melt tickets represents an index of melting procedure and the condition of melting equipment if all other factors are equal.

Final entries on this report will give actual temperature of the melt as recorded by the pyrometer and the locations of the molders' floors to which metal is sent. Time of completion stamped on the melt ticket can be correlated to time on the pyrometer recording chart, and pouring temperature verified later if desired.

Suggested Non-Ferrous Procedures

If the necessity for keeping these records can be impressed on the operators and if a spirit of cooperation can be engendered so that they are genuinely enthusiastic in observing rules and practice, some variables and intangibles which plague the foundryman will be eliminated. The records themselves do not produce good castings, but their interpretation will enable the foundryman to do so.

There are as many and varied practices in the melting of metal as there are good and bad practices in the molding of castings. Without becoming involved in a discussion of the relative merits of each practice, it is

felt that the following outline will not create too much confusion:

(1) Try to melt in a neutral or slightly oxidizing atmosphere. Check this by Orsat to determine quantitatively where this will be on controls. Afterwards, use a piece of bright zinc moved through the flame as a check. If the zinc remains bright, the flame is neutral. If the zinc becomes smoked, the flame is reducing. If a whitish film forms on the zinc, you are probably feeding an excess of oxygen and cooling the flame. If you melt reducing and find it out too late, you may be able to oxidize the melt artificially and in many cases purge it of reducing gases by this practice.

(2) Determine deoxidation procedure and follow it closely. Weigh out the deoxidants on a scale and bag them for future use. Plainly identify the bags' contents by rubber stamping the outside of the bags or using different colored bags. Keep deoxidants in a hot dry place. Damp deoxidizers in shot form have spoiled

Sturdy carts for making up and transporting metal to and from furnace department are good investment.

more metal than they have cleared. Above all, give deoxidizers time to work.

(3) Gage the quality of melt in one of several ways. Use of a chill cast fracture bar of small section leaves much to be desired but will give an indication. Pour a slug 2 in. in diam. by 2 in. deep in an open cope sand mold. Pour directly into the cavity and cover immediately with dry charcoal. Observe the resulting piping or spewing. This can save many hours of molding time, otherwise wasted because poor quality metal resulted in rejected castings.

(4) Establish a system of controls to predict and correct, if possible immediately after melting and before pouring, physical qualities of metal melted.

(5) Reduce gas pick up by (a) minimum superheat, (b) short cycle melting, and (c) combustion atmosphere control.

(6) Don't chill a superheated melt down to its proper temperature by dropping in an ingot or a gate. Even warm metal may cause trouble if it is greasy or caked with earth. Take advantage of the slow cooling process in air and allow the bath to purge itself of deleterious gases.

(7) Pig your overrun in ingot molds instead of a sand heap, because this practice reduces contamination of both sand and metal, reduces metal losses in the form of shot, gives a more identifiable pig, and provides a more readily handled and storeable item.

(8) Use clean, dry pouring ladles.

(9) Use trained pouring crews and keep them alert to rigid standards. Close supervision of this phase is important. Whether you are a "hot metal man" or a "cold metal man" or a "slow pourer" or a "fast pourer" seems to make little difference in the quality of the castings if supporting practices throughout your shop are built to give results. In many cases, rejected castings can be traced to faulty pouring.

Molding Records Are Important

The second department to be investigated and one which is a source of records for general foundry practice, is the molding department. First subject raised in this department is the science or technique of gating and risering. It is obvious that the subject is too broad to be covered here, especially if pro and con points are to be considered.

Certain records can establish practice on solid ground. If methods used in making one good casting are repeated, it should be possible to make a second and a third, and if some of these methods apply to two or three types they may apply to more. The problem is to obtain and compile these records in such a way that the proper practice will be obvious.

Only Simple Records Necessary

Consider the following simple records. Some may be kept on paper, some in wood or metal, and some in the mind.

(1) A card index system for the foreman showing the customers' name and the pattern number and alloy for each job that the shop wants to record. A sketch of the casting showing gating and risering; position and sizes of gates and risers; heights and diameters of risers; sizes and locations of chills and chokes; sizes of flasks and partings made; types of sands, both molding and core; mold and core hardness where critical; amount of metal required to pour and number and size of crucibles; pouring temperature and pouring time; time factor required for production of the mold; and a photograph immediately after shakeout—"One picture is worth 10,000 words."

Prepare Record During Mold Layout

This record can be prepared when the job is laid out with the molder. If the foreman understands what he wants, he can quickly describe and sketch it to the molder. Thus the foreman is preparing the sketch while laying out the job. If the molder understands the foreman, he can work faster and without groping around and making mistakes which later will have to be corrected or patched in. Any minor changes can be made on the record card by the molder or foreman as the job progresses. As changes are made from job to job or year to year they should be incorporated into the record.

One of the best and most complete records on a job is gated and plated pattern. Add to this equipment an identifying symbol on the runner, riser and down sprue bowl and the alloy is known. Paint or otherwise

mark the plate with the pouring temperature and pouring time and this variable becomes a constant value. The remainder of the information can be card recorded.

While these records will assist the supervisor in establishing and duplicating good foundry practice, other tools of production will assist the molder in producing to shop requirements. Consider the following:

(1) In the case of loose patterns, ram up loose wood runners so proportioned as to give proper flow of the metal into the mold cavity.

(2) Paint on the patterns: (a) size and location of gates, (b) size and location of risers, (c) size and location of core vents, and (d) identify the position of these places by pushing a thumb tack into the pattern. This will reproduce on the mold face and warn the molder that something is to be done here.

(3) Use wood patterns of chokes to ram up in the mold, rather than rely on the molder to gage the cross-sectional area of the choke as compared with integrated cross-sectional areas of all runners, gates and sprues.

(4) Ram up wooden plugs to establish size and location of risers and down sprues. A rammed-in riser or down sprue will generally present a better sand face to resist deterioration from flowing metal than a punched riser or sprue.

(5) On a job prone to scab or buckle or swell, an indication of the area on pattern showing the mold hardness painted thereon will guide the molder in his ramming.

(6) Talk, work and reason with men in the shop. Try to educate and convince them that they are not to change standards of practice which have been set. This without doubt is a difficult job. False security engendered by a period of relative freedom from trouble has weakened more good foundry practice than errors in thinking and judgment.

Necessity for Good Sand Records

The second important factor in obtaining records for good practice in the molding department is sand. The place to begin is in setting up requirements to be met by suppliers of the sand. Perhaps the most elementary and unsatisfactory order ever written calls for "one carload of sand same as previously supplied." All that this order will guarantee is that the sand supplied was probably passed up by a more exacting purchaser. The other extreme, setting too-rigid requirements, is pointless and may cost an unnecessary premium. It will not make any better mold than can be produced from sands intelligently bought.

The small- and medium-sized foundry may find it wise to purchase any one grade of sand from one supplier. There can be a meeting of the minds on common ground because of less divided responsibility. The possibility of close reproduceability of succeeding shipments is increased.

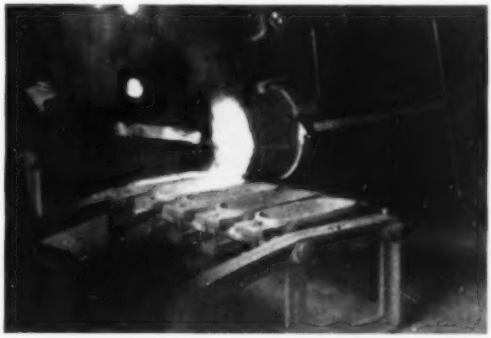
Minimum specified description of the sand should include type and general location of the pit from which the sand is mined. This will identify many physical characteristics of the sand. Clay content, fineness number and moisture content of sand as received should be clearly indicated. If sand is to be purchased in the open market on bid, give the screen analysis and allowable nominal tolerances on grain distribution.

There are several points worth mentioning on the subject of raw sand. It is felt by some foundrymen that the best sand practice will be found in the shop with the driest sand in storage. This is particularly true in the case of natural sands, where repeated handling or mulling of wet sand causes clay to agglomerate. Should these balls of clay come in contact with the metal at the mold face, a blow will result.

Kiln-dried sharp sand can be recommended for several reasons. A known moisture content as a starting point in the preparation of mixes is one. A second is the ease of introducing and dispersing dry binders before adding moisture. Added cost of drying is offset to a limited extent by elimination of freight on shipped-in moisture and because payment is made on sand shipped, not water plus sand.

Most suppliers furnish clay and sieve analysis of sand shipped. It is wise to correlate this by tests.

The same general remarks concerning the necessity for brevity on gating practice will apply to sand practice. There are many ways to arrive at the same objective and to advocate one at the expense of the others is pointless. As usual, tools to record progress by any method are available for the foundryman to use. The average shop can afford to have and use a permeability meter, a moisture teller and a universal tension and compression testing machine. There are various models and types which generally will fit the foundryman's budget. Combine with the above a small electric muffle furnace, grain classifying equipment and a mold hardness tester and it is possible to record much of the data needed.



Pigging excess metal in cast iron chills is a means of both saving and facilitating handling of metal.

Test Results Must Be Utilized

Results of tests by this equipment will be of little use unless the operator is ingenious enough to correlate them with conditions existing in the shop. For instance, permeability, green compressive strength and moisture frequently can be obtained from each heap in the shop and the recorded results may be within the limits of an acceptable sand. Still the castings produced in sand from these heaps may indicate defects attributable to poor sand practice. In the first place, this is because the sample should have been rammed in the rammer in accordance with standard instructions. Depending

on the various sands being tested, a wide range of hardness can be obtained by testing the rammed specimen while in the tube with a mold hardness tester. If for instance a hardness test of the sample showed 30 points of M/H and the test of a pocket in a mold of this same sand showed 50 points M/H, then possibly trouble might occur. This might be especially true if the permeability was declining to the borderline. The added hardness in the pocket would indicate a probable lower permeability at that point and would be a reasonable explanation of any blows that might occur here. A wise precaution then would be to check the permeability of a sample rammed to the equivalent hardness of the troublesome spot on the casting.

High green compressive strengths are not always the solution to a swelled casting. High G.C.S. coupled with a tough sand of low flowability can produce as many swells as a weak sand. Here again a mold hardness meter can indicate when to sacrifice compressive strength and obtain flowability. The practical application of testing tools to shop problems may give the answer. Abstract figures seldom solve problems in the shop.

Sand Durability Tests

Practical tests on the usability and durability of sands are of great value. If sand can be watched while in contact with metal or with heat, a great deal can be learned. It is often possible to cut away sections of a cope and watch the action of metal in the mold against the sand. An easy test can be performed with the muffle furnace raised to the temperature of the metal. A rammed specimen can be placed in the furnace and observed through a large pyrex window that can be slid into position, temporarily replacing the door of the muffle. Spalling, cracking, sintering, fusion and failure can be witnessed and intervals timed.

A rammed specimen can be plunged into a crucible and submerged for a period of time and withdrawn and inspected at intervals as desired. These practical methods of testing are the ones that the foundryman needs and should be used more frequently. Abstract figures obtained by physical testing are valuable only in that they indicate a trend. The fact that it is known that sand is deteriorating is not helpful unless it is possible to interpret these figures and by corrective measures reverse the trend. Visual results as to ability of sand to stand use and abuse are often easier to correlate with good castings than results of physical testing alone.

Core Department Sand Practice

The third department which will contribute records toward the establishment and evolution of good foundry practice is the core department. Much of what has been said about sand in the molding department will apply to the operations in the core department. Check the following points:

(1) Adopt a reasonable purchase specification for core sand.

(2) Enforce observation of the specification by your supplier.

(3) Consider the economies of buying kiln dried sands.

(4) Establish satisfactory mixtures of sand, moisture and binder. Eliminate the variation of these units of measure in the mix by providing (if necessary) homemade measuring cups, boxes or barrels, wherein exact volumetric measures of sand, binder and moisture based on weight can be made repetitiously and correctly. Do not let mixers use one "wheelbarrow" of sand and two "shovels" of dry binder and a "coffee can" of oil, plus a "dash" of kerosene.

(5) Establish time-temperature relation to obtain a properly baked core.

(6) Rely on a reputable supplier of binder to satisfy your requirements. Almost any combination can be compounded to give the results sought.

(7) Frequently review and observe operation of the

Weighing out ingredients for sand mixes. In background dump-bottom buggy holds measured sand load.

department to eliminate any possible deviation from established practice.

(8) Test results of practice by immersion of test specimens in crucibles of the alloy in which core sand is to be used. Observe ability of the core to resist immediate deterioration; later, its tendency to burn out and collapse; its resistance to penetration; its susceptibility to spalling, buckling, straining. These tests can be run in a hot muffle in many cases for better observation.

The last production unit which will yield valuable records is the cleaning department. It is here that results of practice are judged, and from these results it is possible to know the quality of practice. It is the considered judgment of seasoned foundrymen that cooperation between the cleaning department foreman and the foundry foreman will eliminate more trouble and establish better practice faster than any other tools. A prompt report of castings inspected immediately on delivery to the cleaning department will warn in time to reduce losses. Training of employees to be alert for faults and defects not evident during early inspection and to report them to the foreman immediately is of equal importance.

Provision should be made in the production set-up for special attention to pilot runs and "first of the lot" castings so that a prompt report can be relayed to the foundry foreman. Balance the productive capacity of both molding and cleaning departments so that as nearly as possible all castings are cleared within eight hours of pour-off.

Observance of these fundamentals will make it easy to produce an all-important report which is proof of the efficiency of plant practice—the "Scrap Report." This report should be prepared daily and can be consolidated and summarized monthly. The work of preparing this report should rest on two men, the foundry foreman and the cleaning room foreman.

Melter boss stamping an individual melting report to show the time of starting or stopping the heat.

Information should be obtained from one source—that residue on the inspection table in the cleaning department which failed to pass to shipping.

Information should be tabulated after the shift is ended and rejected castings returned to foundry backscrap before the next shift starts. Failure to observe a rigid routine in preparation of this report will often render it valueless. Particularly is this true if rejects are allowed to accumulate over several shifts. The report should be dated and individual entries for each day should show the customer's name and the pattern number of the defective casting. The alloy will further assist in identifying it.

Classification of the defect and the number of such defectives should be entered, together with their weights. It is not enough to know how many castings weighing so many pounds are rejected. If corrective steps are to be taken, the kind of defect must be known. Evasive and vague descriptions of the defects make the report worthless. Rather than use the simple description, "dirty," to cover the multitude of possibilities for rejections, it would be better to eliminate the preparation of the report and devote the energies of the men to other and more useful work. A brief description that can be correlated to losses on previous or future runs is what will be needed. Individual entries will direct the general effort toward eliminating defectives.

Weekly or monthly summaries should tabulate losses by classification of defects, and although it is not entirely a good index, attention should be given to the correction of defects in proportion to the weight of defectives produced. Thus, if a majority of "dirty" castings were correctly classified as "drossy," the shop might direct its efforts toward proper gating, while if a lesser portion was "dirty" because of "washes at the ingates", then a proportionate amount of effort could be given to sand conditions. Attention to one type of defect when causes are different will not produce results unless the proper causes are treated.

In summary it should be stated that non-ferrous foundry practice is a naturally evolved set of rules governing shop operations which can be determined by evaluation of elementary records and observance of certain practical shop tests. As the scrap report is reduced, the adoption of a combination of rules which accomplish that end will automatically become accepted practice.

Although matters involving costs have not been touched in this article, this factor will significantly affect the acceptance of standards of non-ferrous foundry practice.

Future Meetings and Exhibits

ELECTRIC METAL MAKERS GUILD, annual meeting, Shawnee Hotel, Springfield, Ohio—June 1-3.

INSTITUTE OF BRITISH FOUNDRYMEN, 47th annual conference, Buxton, England—June 6-9.

AMERICAN ELECTROPLATERS' SOCIETY, fourth international electrodeposition conference, Statler Hotel, Boston—June 12-16.

UNIVERSITY OF MICHIGAN SCHOOL OF PUBLIC HEALTH, in-service training course in industrial hygiene and human relations for safety personnel, Ann Arbor, Mich.—June 19-21.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, The Homestead, Hot Springs, Va.—June 22-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting and exhibition, Haddon Hall, Atlantic City, N. J.—June 26-30.

STEEL FOUNDERS' SOCIETY, annual fall meeting, The Homestead, Hot Springs, Va.—Sept. 25-26.

ALL-CANADIAN FOUNDRY CONFERENCE, sponsored by A.F.S. Eastern Canada and Ontario Chapters, Hamilton, Ontario—Sept. 28-29.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, annual meeting, The Greenbrier, White Sulphur Springs, West Virginia—Oct. 12-14.

NON-FERROUS FOUNDERS' SOCIETY, annual meeting, Hotel Statler, Boston—Oct. 13-15.

GRAY IRON FOUNDERS' SOCIETY, annual meeting, Netherland Plaza Hotel, Cincinnati—Oct. 13-14.

TEXAS REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Texas Chapter, Plaza Hotel, San Antonio, Texas—Oct. 19-20.

AMERICAN SOCIETY FOR METALS, national metal exposition and Congress, International Amphitheater, Chicago—Oct. 23-27.

METALS CASTING CONFERENCE, A.F.S. Central Indiana and Michiana Chapters and Purdue University, at Purdue, West Lafayette, Ind.—Nov. 2-3.

TELL EARLY PLANS FOR 1950-51 REGIONAL FOUNDRY CONFERENCES

A NEW REGIONAL foundry conference, to be sponsored by the Texas Chapter of A.F.S., and two in the discussion stage —St. Louis District and Northwest—are on the 1950-51 schedule along with the traditional sectional meetings held regularly in recent years. To be held at the Plaza Hotel, San Antonio, October 19-20, the Texas Regional Foundry Conference is under the chairmanship of James R. Hewitt, Houston, Tex. He replaces Malcolm J. Henley, Texas Foundries, Inc., Lufkin, who relinquished the chairmanship when his work took him out of the Texas area.

Deciding last year not to have full scale regional meetings every year such as were held in 1947 and 1948, the Eastern Canada and the Ontario Chapters start their every-other-year schedule with an All-Canadian Foundry Conference to be held in Hamilton, Ont., September 28-29. Murray N. Tallman, A. H. Tallman Bronze Co. Ltd., Hamilton—new Ontario Chapter chairman—is in charge with Chapter Vice-Chairman R. H. Williams, Canadian Westinghouse Co. Ltd., assisting. Meetings, all to be held at the Royal Connaught Hotel, include a three day sand lecture course and a variety of technical papers and discussions.

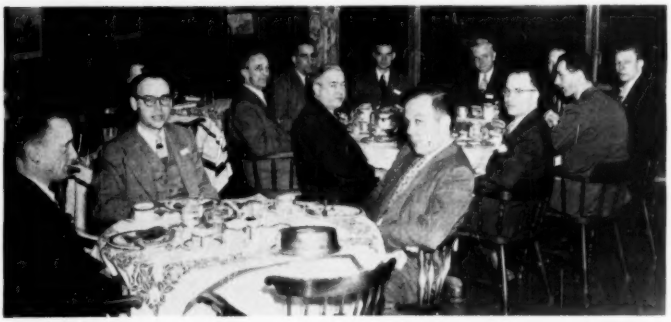
Preliminary plans announced for the Metals Casting Conference indicate the two-day meeting will again be held at Purdue University, West Lafayette, Ind., under the sponsorship of the university and the Michiana and Central Indiana Chapters. Dates are November 2 and 3.

Dates for the next Birmingham Regional Foundry Conference—February 22 and 23, 1951—were selected at the close of this year's conference. As usual the meeting will be held in the Tutwiler Hotel, Birmingham, Ala., and will include technical sessions and visits to some 25 plants in the area.

On dates not yet established, the Fourth Ohio Regional Foundry Conference will be held in Cleveland in the spring of 1951. Host chapter will be Northeastern Ohio with the other Ohio chapters—Cincinnati District, Toledo, Canton District, and Central—cooperating.

Cooperative educational activities in which foundrymen exchange "know how" on current foundry conferences are often held at and under the co-sponsorship of educational institutions. Several have become the focal point for gatherings of students, graduates, and faculty members (see below) interested in comparing notes on foundry developments.

Some of the 25 University of Cincinnati students attending the Ohio Regional Conference in Cincinnati earlier this year posed with their teachers for Wilfred H. White, Jackson Iron & Steel Co., Jackson, Ohio. Front row, left to right, Prof. John F. Kahles, Merrick F. McCarthy, Allen C. Hopes, Harry C. Barney, and Rodney P. Elliott. In the back row are Prof. D. L. Crews, Instructor Fred E. Westerman, George Walcher, W. E. Littmann, Wm. R. Hiatt, and Vincent Hudako.



The breakfast gathering of Ohio State graduates now in the foundry industry—many former members of the A.F.S. student chapter there—included a number of non-OSU conference attendants. Clockwise around the small table (starting left) are John L. Shinn, Dayton Malleable Iron Co., Dayton, Ohio; Herbert F. Scobie, editor, AMERICAN FOUNDRYMAN; and Harry E. Grabel, Ohio Malleable Iron Co., Columbus. Clockwise from Secretary-Treasurer Wm. W. Maloney (left foreground at large table) are L. A. Danse, General Motors Corp., Detroit, a conference speaker; Arthur N. Saulino, student; William E. Dundon, Duriron Co., Dayton, Ohio, first chairman of the OSU Student Chapter; National President E. W. Horlebein; Professor D. C. Williams, faculty adviser to the student chapter; Joseph N. Leaverton, Hamilton Foundry & Machine Co., Hamilton, Ohio; Peter A. Thomas, Central Foundry Div., General Motors Corp., Defiance, Ohio; and John M. Farnbacher, GHR Div., Dayton Malleable Iron Co. Not shown are Gail P. McCleary, Superior Foundry, Inc., Cleveland; and Harry E. Placke, GHR Div., Dayton Malleable, a conference speaker. They also attended this year's annual OSU breakfast. Questioned on their reaction to the foundry industry the former students said: Most alert industry today . . . Chance for interesting career . . . Promising . . . Rough and interesting . . . More responsibilities than any other industry . . . Progressive.

Pleased with the new student chapter at Michigan State College are F. J. Walls, International Nickel Co., Detroit (left), and Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., both A.F.S. past presidents.

Above left to right are Professor C. C. Sigerfoos, National Director F. C. Riecks, Ford Motor Co., Dearborn, Mich., and Collins L. Carter, Albion Malleable Iron Co., Albion, Mich., chapter's industrial adviser.

Install Eighth A.F.S. Student Chapter At Michigan State College

Fred W. Schwier
Secretary-Treasurer
MSC Student Chapter

TWO PAST NATIONAL PRESIDENTS and a national director of the American Foundrymen's Society participated with Michigan State College officials, and officers and representatives of various Michigan chapters, in the installation of the Society's eighth student chapter April 5 in East Lansing, Mich. Presentation of the cast iron rattle to Chapter Chairman Edward H. Fauth, symbolizing official recognition as the baby chapter of A.F.S., was made by Herbert F. Scobie, editor of the Society's official publication, AMERICAN FOUNDRYMAN. More than 30 students and a like number of foundrymen witnessed the ceremony.

Highlight of the dinner meeting in the college's new Union Building was the address by National Director F. C. Riecks, Ford Motor Co., Dearborn, Mich. He outlined the broad background and training a modern foundry engineer should have to meet the increased technological demands of the foundry industry.

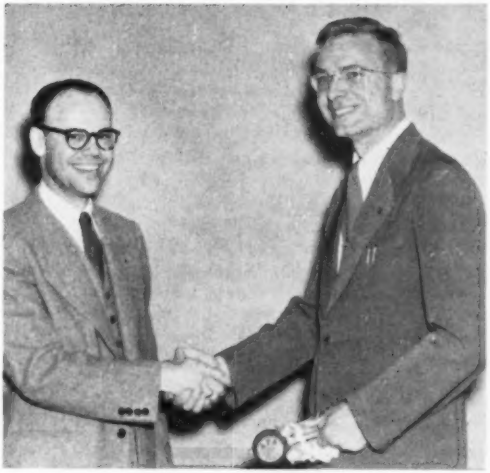
Past presidents who congratulated the students and the college on the establishment of the student chapter were F. J. Walls, International Nickel Co., Detroit, and Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Collins L. Carter, Albion Malleable Iron Co., Albion, Mich., a director of the Central Michigan Chapter and industrial adviser to the new chapter addressed the group on their future in the foundry industry. He ended his talk by emphasizing the importance of industrial contacts and invited the chapter to visit Albion Malleable.

Welcome to the campus of Michigan State College was extended to the student chapter and to A.F.S. by Dale Faunce, counselor for men, and Professor Roland T. Hinkle of the mechanical engineering department.

Other speakers included Professors Austen J. Smith, faculty adviser, and Charles C. Sigerfoos, who instigated formation of the chapter, Fitz Coughlin, Albion Malleable Iron Co., chairman of the Central Michigan Chapter, and representatives of the Detroit, Saginaw Valley, and Central Michigan Chapters.

Presiding throughout the meeting was Chapter Chairman Fauth. Attendants at the installation received an aluminum ash tray, a replica of the college stadium, cast in the school foundry by members of the chapter.



Above—Congratulating Chapter Chairman Edward H. Fauth (with cast iron rattle) is AMERICAN FOUNDRYMAN *Editor Herbert F. Scobie. Below—Fred W. Schwier, secretary-treasurer of the Michigan State Student Chapter (left) and Vice-President Donald I. Huizenga.*

AIR CONDITIONING CRANE CABS

R. D. Darrah
Dravo Corp.
Pittsburgh

AIR CONDITIONING OF CRANE CABS is recognized as increasingly important because of extreme temperatures, dust and dirt, and fume conditions which may be encountered.

Generally, the first consideration in air conditioning a crane cab is the prevailing temperature and relative humidity at the crane operator's level. Table 1 shows temperature and humidity in several types of crane operation. Such information is required to calculate the sensible and latent heat which must be removed to maintain normal conditions within a cab.

Actually, a crane operator working in high ambient temperatures is subject to artificially induced fever. When body temperature exceeds 102 F, men work with quickly declining efficiencies and may suffer heat exhaustion, heat cramps, fatigue, and headaches. Around 104 F, a person becomes subject to mental disturbances, apathy and poor judgment, according to health authorities. The only way of reducing temperatures to normal comfort standards of between 80 and 85 F is by mechanical refrigeration.

Tests have indicated that most dusts in the steel plant atmospheres do not contain any one particular constituent in sufficiently large quantity to be considered a health hazard. Slag dust, sand fines, ferric oxide, earth dust, manganese particles and coke dust are the basic constituents. However, in foundries making large sand castings, and in the non-ferrous industries (lead, copper, zinc, cement, etc.) dusts may present a health hazard. Viscous, cleanable, impingement type filters, or cotton or wool bag filters, can remove dust and dirt to a sufficiently low concentration that no irritation or annoyance exists.

Table 2 lists some irritants found in the atmospheres of the metal industry—several of these exist in foundries to a greater or lesser extent—with their maximum allowable concentrations during an 8-hr work day. Figures in the first column of Table 2 are parts of gas or vapor per million parts of air by volume (ppm), and the second column gives the round-number equivalent of these limits in milligrams of substance per cubic meter of air (mg/m^3).

The majority of these vapors and gases are irritants and general poisons. Irritants might cause inflammation of the skin, eyes, or respiratory tract; poisons produce remote, usually systemic, poisoning rather than local effects. Other gases and vapors like carbon monoxide and various cyanide compounds do no direct damage to the lungs, but induce asphyxiation by interfering with the supply or utilization of oxygen.

Activated carbon in crane cab air conditioning units reduces concentration of these gases and vapors considerably below the maximum allowable. Carbon monoxide is the most feared gas because it cannot be detected by sight or smell. Activated carbon in any form will not absorb this particular gas. However, tests have shown the air conditioning of a crane cab does provide a dilution of the carbon monoxide concentration inside the cab.

The design and construction of the crane cab is an important factor. The ceiling and sides of the cab should be insulated with at least 2 in. of standard insulation. The floor of the cab should have a minimum of 4 in. of insulation, preferably 6 in.

Due to the visibility requirements in the cab, it is necessary to carefully consider the types of windows

TABLE 1—TEMPERATURE AND HUMIDITY CONDITION IN VARIOUS TYPES OF CRANE OPERATION

Crane Operation	Ambient Temp. Dry Bulb, F	Ambient Temp. Wet Bulb, F	Relative Humidity, %	Moisture, grains	Body Temp., F
Ladle (open hearth pit side)	150-160				
Foundry (large castings)	140-150				
Charging (open hearth)	146	88	11	108	102.5
Electric Furnace	142	86	10	105	102
Aluminum Remelting	130	81	12	82	101
Brass and Bronze Casting	100-125				
Steel and Iron Casting (small)	120	80	18	90	99.6

The specific temperatures, R.H., etc., given for the various temperature ranges represent averages of numerous recordings taken by the author and do not necessarily apply to the crane operation directly opposite.

Normal body temperature, 98.6 F. Temperature ranges based on 175 recordings.

TABLE 2—MAXIMUM ALLOWABLE CONCENTRATIONS—GAS, VAPOR, MIST, DUSTS

Material	Parts per Million	mg per cu meter
Acrolein (Acrylaldehyde)	0.5	1
Arsenic		0.15
Arsine	1	2
Bromine	1	5
Cadmium		0.1
Carbon Disulfide	20	50
Carbon Monoxide	100	100
Chlorine	5	10
Chromic Acid		0.1
Fluoride Dusts, Smokes		2.5
Hydrofluoric Acid	3	
Hydrochloric Acid (Hydrogen Chloride)	10	10
Hydrogen Cyanide	20	20
Hydrogen Fluoride	3	2
Hydrogen Selenide	0.1	0.2
Hydrogen Sulfide	20	20
Iron Oxide		15
Lead		0.15
Magnesium Oxide		15
Manganese		6
Mercury		0.1
Nitrogen Oxides	25	100
Ozone	1	2
Selenium Compounds		0.1
Phosphine	1	1
Sulphur Chloride	1	5
Sulphur Dioxide	10	25
Sulphuric Acid		5
Tellurium		0.01
Zinc Oxide		15

most desirable for cab operation. Three types of glass have been used for windows. One, considered best for small windows, is ¼ in. laminated safety glass. Where fairly large windows are desirable, hermetically sealed, double glazed windows are most effective. Where one full side of the cab is glass area, heat absorbing, surface-hardened glass should be used. All ducts carrying supply and return air from the air conditioning unit to the cab should be provided with 2-in. thicknesses of standard insulation material where exposed to high temperatures.

In crane cab coolers manufactured by the author's company, the filtering system consists of a primary filter installed in one side of an elbow through which makeup air passes. This combines with recirculated air and passes through a secondary filter directly in front of activated carbon canisters. The system of using two filters in series represents an efficiency of approximately 95 per cent because both makeup air and recirculated air are being filtered continuously.

After the air has passed through the dust and dirt filters, activated carbon canisters and over the cooling coil, it is supplied to the crane cab by a ventilating fan. The fan motor is in the cool air stream, operating in 60 to 62 F air, which prevents overheating. Approximately 400 cfm is discharged into the cab, 25 per cent of it makeup air.

Electric strip heaters are installed directly in front of the cooling coil for winter heating, if needed. Cab temperatures of 68 to 72 F can be maintained continuously with the heaters in cold weather.

Crane cab coolers have solved many problems in industrial plants. A few of interest to foundrymen are:

Tar fumes from dipping tanks permeated the atmosphere in a foundry and caused considerable annoyance and nuisance. There also were sand, dust, and steam problems. Temperatures reached approximately 140 F, but installation of crane cab air conditioning permitted the crane operator to work under satisfactory conditions (Fig. 1).

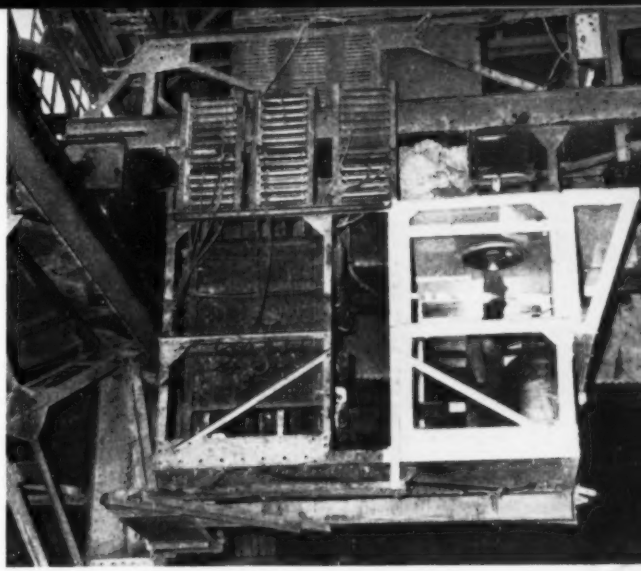
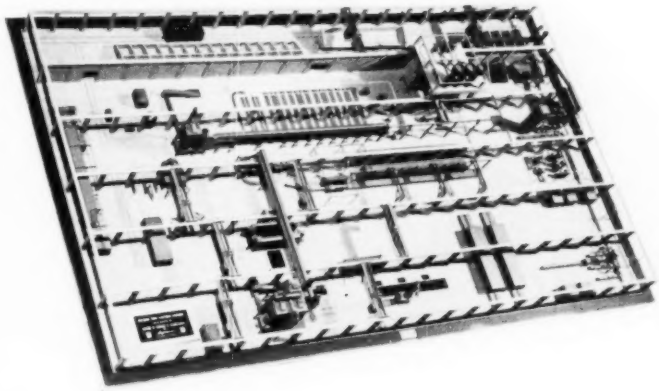


Fig. 1—An air conditioned foundry crane installation on which it was possible to mount the air conditioning unit directly over the crane cab. This type of installation requires a minimum amount of the heavily insulated and relatively expensive ductwork which carries supply and return air.

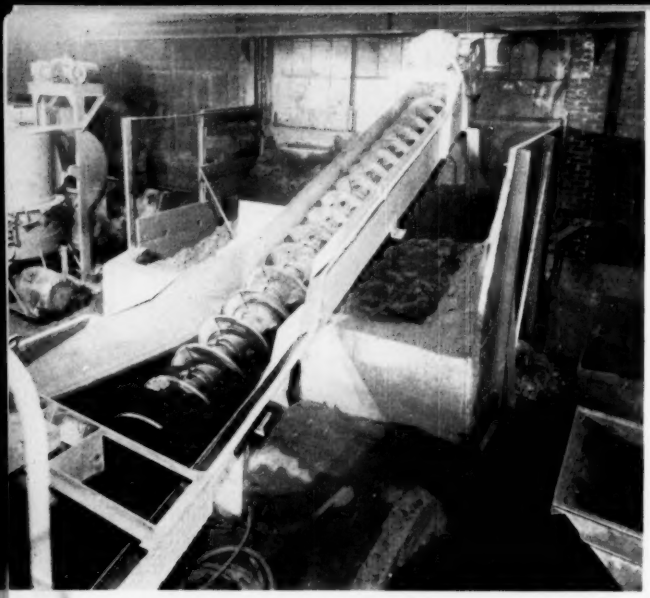
In another plant, a crane cab with glass walls operates in temperatures around 135 to 140 F. Due to open wall areas around the building, heat is required during the winter months in addition to cool air during the summer.

Carbon monoxide concentrations were reduced 80 per cent at one particular installation where carbon monoxide, dust, and sulphur dioxide were problems. Temperatures reached 140 F.

Scale Model At A.F.S. Convention Shows European Machine Tool Foundry



Soon to be completed in Europe, a new machine tool castings foundry designed by Lester B. Knight & Associates, Inc., Chicago, was shown in miniature at the Annual Convention and Exhibit of the American Foundrymen's Society just ended in Cleveland. Floor space of the foundry will be approximately 270,000 square feet. Facilities will permit production of up to 60 tons per 8-hour shift with approximately 50 man hours per ton. Castings will vary from a few ounces to about 15 tons in weight.



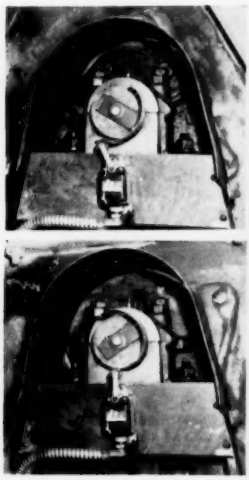
One step in the processing of used core sand at Advance Foundry Co., Dayton, Ohio, is disintegration of core lumps and removal of excess water. Castings are cleaned and cores are removed by hydraulic sand blasting at Advance. Sand from the high pressure stream of water, sand from the casting, and water, flow through a floor grate in the cleaning room into a combination washer-classifier-dehydrator. The action of the screw illustrated breaks any lumps that may be present and delivers clean, dewatered core sand to a concrete storage bin ready for use in core mixtures.

⬆ HOW TO DEWATER CORE SAND

MODERN FOUNDRY METHODS...

CONTROL FOR CUPOLA MIXING LADLE ⬇

A simple, effective electrical control on the mixing ladle at Minneapolis-Moline Co.'s Lake Street Plant, Minneapolis, assures a minimum of 2000 lb of molten metal at all times and makes for uniformity of metal composition and temperature according to H. H. Judson and Nathan Levinsohn who developed it. Main elements in the system are a warning horn mounted on the operator end of the ladle, and on the other end a limit switch which engages a strip bent to form a segment of a circle. The latter turns with the ladle and is adjusted to move the limit switch when metal in the ladle is down to a ton. When the horn sounds the mixing ladle operator cuts off the flow of metal into the transfer and pouring ladles. The control system, which replaced a 100 per cent electrical control system, was made by the Minneapolis-Moline electrical and maintenance departments.



Mixing ladle control with ladle in normal position (upper) and tilted (lower). In over-all view at right continuous tap cupola pours metal into mixing ladle while metal fills transfer ladle.

FURTHER RESULTS OF BELGIAN NODULAR CAST IRON RESEARCH

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NODULAR CAST IRON may be obtained by special treatment of molten iron which will be described. (EDITOR'S NOTE: DR. DE SY'S ideas on terminology appear in AMERICAN FOUNDRYMAN, October, 1949, p. 35.) To judge the result of the treatment, it is best to rely on a very careful microscopic examination of a well polished sample, and to make a test (for instance, a tensile test on a sound test bar). However—and this is extremely useful to the foundryman—a look at the fracture of any kind of specimen distinguishes a failure from a partial or total success.

The fracture of nodular cast iron (Figs. 1A and C) shows a clearly metallic gray, and fibrous or coarsely granular structure, according to the speed of cooling. In the first case it resembles the fracture of a superheated nickel-chromium steel; in the second, the fracture of a superheated tool steel. If the fracture is characteristic of that of a ductile material (Fig. 1A) we may generally expect excellent mechanical properties, especially an appreciable elongation.

Mechanical properties of a cast iron, like those of any other material, are closely related to the structure —the form and distribution of the constituents, particularly graphite. Gray cast iron often is said to consist of a steel matrix interrupted in many places by graphite flakes. The influence of the graphite is shown approximately by Table 1.

Graphite Form Influences Ductility

It should be pointed out that, even if it is comparatively easy to obtain a tensile strength of 100,000 to 105,000 psi (one of the author's castings has given 121,000 psi with 2.25 per cent elongation) it is rather difficult to obtain an elongation of 4 per cent in the case of a completely pearlitic matrix. Such an elongation can be obtained only if the graphite occurs in the form of compact and well formed spheroids; graphite in any other form has an unfavorable influence on the ductility. Elongation may increase greatly if the matrix contains free ferrite, and can reach 25 per cent if the matrix is completely ferritized by heat treatment.

While it may be difficult, or even impossible, to force crystallization of all the graphite into compact spheroids, it is comparatively easy to approach this perfect stage and to obtain the form and the distribution shown in Fig. 2. The distribution of the nodules is regular, and their size probably will be relatively constant and correspond to the greatest to be observed on any section like the polished face of a metallographic sample. A diameter of 40 to 50 microns appears to be an average dimension.

Graphite is known to crystallize in the hexagonal system, and to show a perfect cleavage parallel to the base of the hexagon. The spheroids of graphite are composed of a great number of crystallites disposed radially around the center of a globe, and generally oriented so that the base of each crystallite is perpendicular to a radius of the globe.

Figure 3 shows a spheroid at 1000 diameters. Such a structure logically suggests the radial growth of the nodule starting from a nucleus or center of crystallization. The existence of the nucleus has not yet been proved. The question of the existence of the nucleus and especially of its nature is extremely important and the solution of this problem would help particularly to understand the mechanics of formation of the spheroids.

Many elements can force the spheroidal crystalliza-

Fig. 1—Fractures of cast iron specimens. A and C are nodular irons, and B an ordinary iron. Carbon and silicon contents of the three irons are approximately 3.5 per cent and 2.5 per cent, respectively.

TABLE 1—INFLUENCES OF GRAPHITE FORM ON PROPERTIES OF GRAY CAST IRON

	Tensile Strength, 1000 psi	Elongation (L = 4D) %
1. Pearlitic cast iron with flake graphite (Si, 2.5%; C, 3.5%; Mn, 0.6%; P, 0.1%)	28.5	practically zero
2. Pearlitic cast iron with vermicular graphite (composition same as No. 1)	71.1	about 0.5
3. Pearlitic cast iron with spheroidal graphite (composition same as No. 1)	106.7	about 4.0
4. Pearlitic steel (Si, 2.5%; Mn, 0.6%)	149.3	about 12.0

NOTE: This paper is based on nodular cast iron research sponsored in Belgium by IRSIA (National Institute for Scientific Research Applied to Industry and Agriculture), and Fabrimetal (Federation of Industrial Enterprises for Metal Fabrication). It was presented as the Official Exchange Paper from the Belgian Foundrymen's Association to the International Foundry Congress, held in Amsterdam, Holland, Aug. 29-Sept. 2, 1949.

tion of graphite, but at present only magnesium offers immediate industrial interest. Magnesium seems to be able to produce iron with the best mechanical properties.

These, and particularly economic considerations, have led Belgian scientific and industrial authorities to study first of all the magnesium treatment; this study is developing and, although some results have been obtained, it would be presumptuous to consider the problem solved. This paper reports the results of researches up to the middle of June, 1949.

Treatment with magnesium is complicated by its relatively low boiling point and its insolubility (at least very low solubility) in iron. The boiling point of magnesium is 2012-2048 F. If a block of magnesium is plunged into molten cast iron at 2550 F, the magnesium melts and vaporizes instantaneously, escaping with violence and carrying along some of the cast iron.

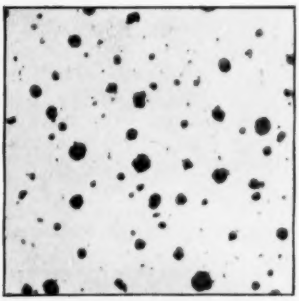

Fig. 2 — Form and distribution of graphite nodules are shown in this specimen from Heat No. 192. Unetched. X100.

Fig. 3 — The structure of this graphite spheroid is suggestive of radial growth from a nucleus or center of crystallization. X1000.

Even on a laboratory scale plunging 0.5 to 1 per cent of magnesium into cast iron heated to 2370-2550 F is dangerous. We have treated 15 to 25 lb of cast iron many times, and at every attempt 1/3 to 2/3 of the contents of the ladle or the crucible of the induction furnace have been thrown out.

There are other inconveniences. The heat lost by the cast iron in heating, melting, and chiefly in vaporizing 0.5 to 1 per cent of magnesium causes a temperature fall sufficient to produce a cold-shut casting or even a frozen ladle bottom. There is no compensation from the heat of combustion of the magnesium because this is delivered to the atmosphere. The most important inconvenience is the hazard of success. Although operating apparently in the same manner, we have obtained the nodular form of graphite in one test and flake graphite in another.

Successful magnesium treatment requires an emulsion of magnesium vapor and liquid cast iron, and this should be more intimate, the shorter the time of contact. To obtain an intimate emulsion, liberation of the magnesium should occur over a period of time and at many places in the molten iron. This can be accomplished by using alloys of magnesium and one or more elements which are soluble in iron.

An important factor is the quantity of magnesium to be added to obtain nodular cast iron. This quantity depends upon the composition of the iron, and the efficiency of the treatment. The latter is a function of the nature and the composition of the magnesium alloy as well as the method of addition.

During the magnesium treatment part of this element is lost by evaporation; the remainder reacts with the molten iron forming components, both soluble and insoluble, some of which enter the slag. The magnesium which reacts with the bath is the useful fraction, and the relation of this quantity to the whole addition is a measure of its effectiveness.

If we call

Mg_{add} – magnesium added;

Mg_{res} – residual magnesium;

Y_o – efficiency;

X – magnesium eliminated by the precipitation of components other than MgS (MgO, perhaps silicates of Mg, etc.);

S_1 – sulphur in the melt before treatment with magnesium;

S_2 – sulphur in the nodular iron;

then 0.75 $(S_1 - S_2)$ is the magnesium used in desulphurization and chiefly eliminated into the slag as MgS (0.75 is the relation of the atomic weights of Mg and S, 24 to 32).

Then we can write the equation

$$Mg_{add} = \frac{Mg_{res} + 0.75\ (S_1 - S_2) + X}{Y_o}$$

Not knowing the value of (X) it is impossible to calculate (Y_o), and we must be satisfied with estimating the apparent recovery (Y) defined by the formula

$$Mg_{add} = \frac{Mg_{res} + 0.75\ (S_1 - S_2)}{Y_r}$$

It is essential to know the value of (Y) and numerical data will be given later.

Although the last formula is empirical and an approximation, it is useful as a basis for calculating the quantity of alloy to be added. Knowing the apparent recovery (Y) of the treatment, and sulphur content of the liquid iron we can calculate Mg_{add} by fixing Mg_{res}.

A successful treatment guarantees a high degree of desulphurization, the sulphur residual in a casting being generally less than 0.01 per cent. However, if residual sulphur is determined in a zone of segregation, such as a riser, much higher sulphur might be found. This is mostly magnesium sulphide. It is therefore essential, when speaking of residual sulphur and magnesium, to define with precision the place from which the borings for analysis were taken.

In our tests the samples for analysis of sulphur and magnesium came from the lower part of a truncated, inverted cone (the inverted truncated cone is always cast for Mg and S determinations; cylinders are cast from the same ladle for studies of the influence of

massivity). Dimensions are: base, 2.4-in. diameter; top, 4-in. diameter; height, 12 in. Samples for analysis of magnesium were taken on the vertical axis between the levels 0.8 and 2 in., beginning from the base.

Considering that the residual sulphur (S_2) is of the order of 0.01 per cent, and because in practice the initial sulphur of the molten iron (S_1) generally is not known in advance to within better than 0.01 per cent, we can replace the factor 0.75 ($S_1 - S_2$) in the formula by 0.75 (S_1).

The residual magnesium in nodular cast iron is about a few hundredths of a per cent; the extreme values found in our tests are 0.025 and 0.12 per cent (spectrographic determination—standard samples furnished by laboratories of Mond Nickel Co., Birmingham, England).

C. K. Donoho[2] considers that the best mechanical properties are obtained with a residual magnesium of 0.05 to 0.06 per cent, and the curve of mechanical properties as a function of the content of residual magnesium shows a very marked maximum. Our tests do not confirm completely Mr. Donoho's results. Indeed, castings containing about 0.08 per cent residual magnesium, and others containing only 0.04 or even 0.027 per cent, have given excellent mechanical properties, as shown in Table 5.

It is prudent to take into account the time between the treatment and solidification, and to augment the calculated residual magnesium as a function of this time. Practically, since we cannot take into account the order of pouring the castings from the same ladle, this means to take into account the massivity of the castings.

It is possible, if not probable, that besides the magnesium combined with oxygen and sulphur some is present in the form of carbides, silicates, etc., or as the element magnesium dissolved or in suspension. This fraction of magnesium is not in equilibrium with the atmosphere, the lining of the crucible or ladle, or the sand and the moisture of the mold, and should necessarily disappear in time through oxidation.

This corresponds to the loss of the effect of the treatment on waiting, such as has been pointed out by Donoho. We are not able to confirm completely his conclusion (loss of 85 per cent of the effect in 6 min) which we consider most unusual. We find that a given time of cooling is far less serious than holding for the same time at a high temperature.

Based on these considerations we have established the following formula for magnesium to be added, in which the massivity is taken into account:

$$Mg_{add} = \frac{\alpha + \beta M + 0.75\ S}{Y}$$

It is unfortunately too early to give numerical values to the coefficients α and βM, our practical tests on massive castings not being complete.

The coefficients fixed provisionally give for a cylinder of 4-in. diameter: $\alpha + \beta M = 0.07$. Then, in order to cast a 4-in. cylinder from a melt containing 0.08 per cent sulphur by means of an addition alloy containing 20 per cent of magnesium and giving recovery of 50 per cent, the addition should be:

$$Mg_{add} = \frac{0.07 + 0.06}{0.05} = 0.26 \text{ per cent,}$$

$$\text{or } \frac{0.26}{0.20} = 1.3 \text{ per cent of alloy to be added.}$$

The composition of liquid iron needed for production of nodular cast iron by magnesium treatment is not very critical. The treatment with cerium needs, according to Morrogh[1], a hypereutectic iron. For the treatment with magnesium the iron may be strongly hypoeutectic. However, it is preferable to come close to the eutectic composition which assures good castability and guarantees strength and ductility superior to what should be obtained with a strongly hypoeutectic composition.

The importance of high carbon contents near 3.5 per cent, together with some 2.0 to 2.5 per cent of silicon (nearly eutectic composition), has been pointed out by Gagnebin, Millis, and Pilling[3]. We can confirm their results. For silicon contents of 2.0 to 2.8 per cent, elongation and strength increase with the carbon content, while the Brinell hardness decreases.

To a metallurgist the increasing strength and ductility, along with increasing carbon content, at first seems paradoxical, even shocking. Close examination provides the reason, which should be sought, of course, in the structure.

Figures 4 and 5 show two cast irons prepared in the same manner in the induction furnace, starting with the same raw materials, given the same magnesium treatment, and the same secondary inoculation with ferrosilicon. The only essential difference is in the carbon contents which are, respectively, 2.02 and 3.56 per cent. Both of the cast irons should be considered as nodular. In Fig. 4 the graphite appears in interdendritic strings of the mixed spherulitic and vermicular variety. This graphite issued from the liquid eutectic phase (or close to the eutectic composition) after the primary solidification of the dendrites of austenite.

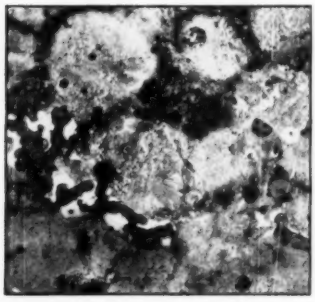

Fig. 4 — Interdendritic strings of mixed spherulitic and vermicular graphite. Composition: C, 2.02; Si, 2.80; Mn, 0.4 per cent. Tensile strength, 71,100 psi. Elongation, practically zero. X300.

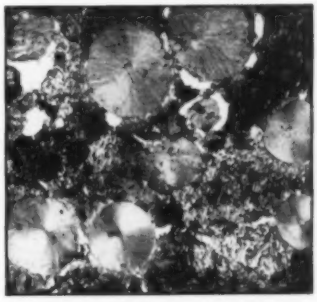

Fig. 5 — Structure of a nodular cast iron of composition C, 3.56; Si, 2.69; Mn, 0.48 per cent. Tensile strength, 120,900. Elongation, 2.25 per cent. Modulus of elasticity, 25.7 (10^6). X200.

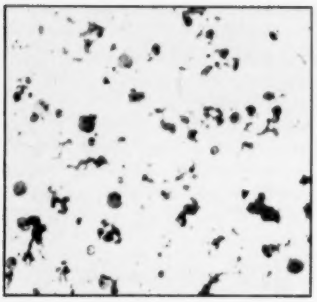

Fig. 6 — Structure of a nodular cast iron produced by treatment with lithium. Unetched, X250.

Fig. 7 — Lithium treated cast iron at X600. Picric acid etched.

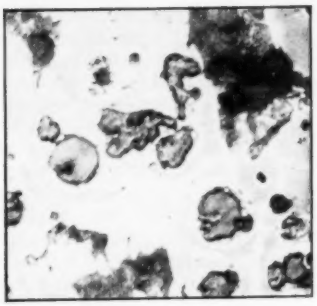

Figure 5 represents a structure of nodular cast iron which is as perfect as can be obtained. The composition of this cast iron comes close to the eutectic. Such a structure should be considered as having developed in the reverse of Fig. 4; the graphite is issued from a phase (probably a complex carbide) of primary precipitation. Such a structure is likely to be obtained only if we succeed in forcing the primary precipitation of almost all the carbon in excess of that soluble in the austenite.

To visualize formation of this structure we can start with a convenient composition and speculate on the concentration gradient of the silicon which is supposed to exist, according to the theory of Eash[4,5], after the secondary inoculation with silicon.

It is premature to issue an authoritative opinion on the mechanism of the formation of the spheroid of graphite. The question is being studied in a plan of international collaboration, and the foregoing hypothesis is for the moment at least useful as a basis for research.

The influence of elements such as manganese and phosphorus does not seem to be fundamental in obtaining the nodular structure. However, the influence of phosphorus on ductility is particularly important, and manganese seems to relate to sulphur but it is not yet possible to give precise information on this point. Sulphur, as has been pointed out, is almost completely eliminated during a successful treatment.

Qualify Nodulizing Elements

The general conditions imposed on the element expected to produce a nodular structure (according to the hypothesis of H. Morrogh[1]) are the (1) it should be a stabilizer of carbides; (2) dissolve easily in the iron; and (3) be a desulphurizer.

The first condition seems to be confirmed more and more as the research on nodular cast iron increases. The second, though not generally true (Mg and Li, are exceptions) is partly correct, the condition of good solubility being replaced by the condition of intimate emulsion, such as is realized with magnesium.

The intimate emulsion is more difficult to achieve with some other elements such as lithium because of the much higher boiling point (2502 F) and equally because of the difficulty of finding a convenient element to serve as a vehicle.

Concerning the third condition, we should consider whether there is a relation of cause to effect between the desulphurization and the production of spheroids of graphite. The desulphurization is a consequence of the great affinity of the elements cerium, magnesium, lithium, etc., for sulphur, but whether this causes nodulation has not been proved.

Possibly the general conditions for an element to be capable of forcing the spheroidal crystallization of graphite should be stated as follows:

1. The element should be a strong deoxidizer capable of reducing suspensions of SiO_2.
2. It should be, to a certain degree, a stabilizer of carbides.
3. It should not form components which may precipitate in the liquid in the hexagonal system.
4. If not soluble in iron, it should be capable of emulsification with iron as a liquid or gas.
5. Possibly the element should be a desulphurizer; it is notable that all the strong desulphurizing elements are also strong deoxidizers, or vice versa.

Other Elements Studied

Exploratory tests with elements other than cerium and magnesium have given encouraging, or at least not completely negative results. Figures 6 and 7 show nodular cast iron obtained by treatment with lithium. Fig. 6 shows the form and the distribution of graphite at 250 diameters; the well formed spheroids, the graphite in the form of crabs and some rods of vermicular graphite, can be clearly distinguished. Total absence of real flakes justifies calling this nodular cast iron.

Other preliminary tests using calcium, strontium, and barium have given less encouraging results. Figure 8 shows the result of a calcium treatment. The graphite is of the supercooled type with well formed spheroids and crab graphite.

As previously pointed out, treatment with pure magnesium involves certain hazards. It is perhaps not impossible that methods will be found which will guarantee success and security which are indispensable for industrial operation, but as far as we know, this method does not exist at the moment.

In our research we have prepared and tried some 50 different alloys, but we retain actually only two or three series. The program of studying the alloys is not exhausted and we still have not studied those based on copper. Now we know in advance that they have indisputable interest.

Hoping to be able to use the smallest proportion of alloy we began by trying the magnesium-rich alloys. These have been abandoned for the same reason as the pure magnesium—very violent reaction and hazard of success. With a violent reaction the recovery can vary between extremely wide limits. To eliminate the suc-

cess hazard we should therefore plan on the minimum recovery, but then the advantage of a small addition is lost and, if the recovery is unusually high, considerable residual magnesium may be obtained. The alloys which guarantee quiet solution, without significant expulsion of molten iron, contain not much more than 15 to 20 per cent magnesium.

The nature of the elements other than magnesium in the nodulizing alloys is of basic importance. These elements should be soluble in cast iron without being harmful, and it is well if their rate of diffusion in iron is great. These elements become the vehicle for getting the magnesium into the bath of iron. If the diffusion of the vehicle is fast, local high concentrations of magnesium can not be established, and an intimate emulsion of magnesium in the iron and consequently a good recovery will be obtained. This explains the poor recovery of magnesium-rich alloys even when the vehicle meets the imposed conditions.

Factors Limit Alloy Selection

Finally, the vehicle should possess a relatively low melting point, show complete liquid solubility, and produce in the solid state a real alloy (solid solution, intermetallic compound, or eutectic). If in addition we consider the ease of production of the alloy and the cost, the possibilities are relatively limited.

The binary, ternary, and quaternary alloys of magnesium with nickel, with silicon, and with copper seem to be the most promising.

As pointed out, we have not yet tried the alloys of copper and, after having made many tests with the magnesium-rich alloys of about ten elements, we have finally selected the following:

1. Ni-Mg or Ni-Mg-C containing 10 to 20 per cent of magnesium and zero to 2 per cent carbon.

2. Si-Mg containing 10 to 20 per cent of magnesium (Si as Fe-Si, 75 or 90 per cent).

3. Si-Ni-Mg containing 10 to 15 per cent of nickel and 10 to 20 per cent of magnesium.

The first series of alloys is relatively heavy and has an efficiency of 50 to 60 per cent; the reaction is very calm and operation does not require any special precaution. As always, the secondary inoculation incorporating 0.4 to 0.6 per cent of silicon is essential to avoid free cementite.

As an example of treatment with an alloy of the series Ni-Mg-C, two industrial tests are cited:

(a) Test No. 5D made on 500 lb of cupola iron of the following analysis: C, 3.35 per cent; Si, 2.4 per cent; Mn, 0.55 per cent; P, 0.18 per cent; and S, 0.073 per cent.

(b) Test No. 6D using 660 lb from the next tap, is supposed to have the same composition.

In No. 5D the magnesium treatment was made with 1.5 per cent of Ni-Mg-C (81-17-2) alloy; for 6D we used one per cent of the same alloy; in both cases the secondary inoculation was made with 0.6 per cent of ferrosilicon containing 77 per cent silicon. Results of these tests are given in Table 2. It is interesting that the recoveries of magnesium in the industrial tests are particularly high and superior to those currently obtained in our laboratory tests, probably due to the small quantities of metal treated in the laboratory.

Table 2 — Effect of Ni-Mg-C Additions

Test No.	Final Composition, % C	Si	Mn	P	Ni	S_t	Mg_{res}	Efficiency, %	Tensile Strength 1000 psi.	Brinell Hardness
5D	3.37	2.82	0.53	0.18	1.2	0.006	0.106	64	96.0	269
6D	3.35	2.52	0.43	0.18	0.83	0.007	0.059	68	109.5	255
7D	3.15	3.08	0.32	0.34	—	0.009	0.053	23	95.3	255
8D	3.16	3.08	0.32	0.42	—	0.007	0.074	34	91.6	255

The alloys of the third series are relatively lighter and the preferred method of addition is to add sized grains to the stream where it falls into the ladle. For this we use an apparatus composed essentially of a funnel and a directing tube.

Although the treatment using silicon-rich alloys gives a high percentage of this element, it is still necessary to make a secondary inoculation with ferrosilicon. Of course, it is necessary to choose an iron with a low silicon content to end with a final content of 2.5 per cent.

As an example, here are the results of two industrial tests with treatment by an Si-Ni-Mg alloy containing 14 per cent nickel and 19 per cent magnesium. Tests 7 D and 8 D (Table 2) were made on 500 and 660 lb

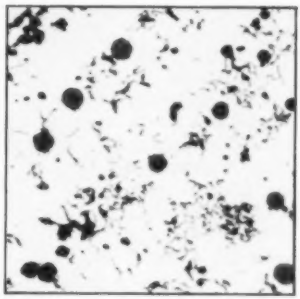

Fig. 8 — Treatment with calcium produced well formed spheroids and crab graphite. Unetched. X250.

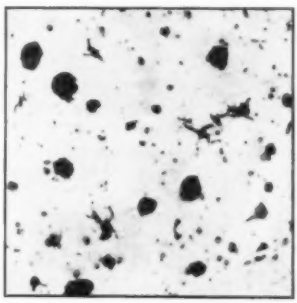

Fig. 9 — Test No. 6D—Graphite form and distribution of graphite at center of 4-in. cylinder. Unetched. X100.

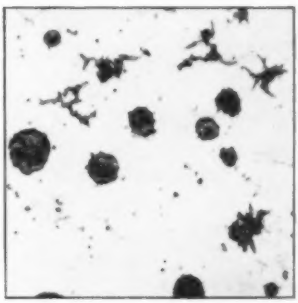

Fig. 10 — Test No. 7D — Form and distribution of graphite at center of 4-in. cylinder. Unetched. X100.

Fig. 11—Test No. 5D—A selected area of this casting is rich in vermicular graphite. Unetched. X400.

Fig. 12—Test No. 8D—This selected area shows crab graphite in addition to compact and twin spheroids. Unetched. X400.

of cupola iron, with compositions expected to be within the following limits: C, 3.2-3.4 per cent; Si, 1.0 per cent; Mn, 0.3 per cent max.; P, 0.2 max.; and S, 0.1 per cent max.

Probably because of an error in the charges, the silicon content was much higher; real composition of a sample of iron, taken at the beginning of the filling of the first ladle was C, 3.35 per cent; Si, 1.72 per cent; Mn, 0.32; P, 0.26 per cent; and S, 0.077 per cent.

In tests 7 D and 8 D, 2.5 and 2 per cent, respectively, of the Si-Ni-Mg alloy were used, with 0.6 per cent of ferrosilicon (77 per cent) as a secondary inoculant.

Because treatment with magnesium requires additions of some 2 and even 3 per cent of alloy, we must be concerned with castability. In the foregoing industrial tests, the temperature of the iron in the spout was 2462-2480 F (real temperature) and, except for the first ladle of 330 lb, all had very satisfactory castability.

The temperature drop was not excessive, the vaporization of magnesium was insignificant—the total addition being only 0.2 to 0.4 per cent of magnesium, and the recovery, especially with Ni-Mg alloys, was high.

Partial combustion without excessive evaporation of the Si-Mg alloys at the surface of the iron bath might provide some temperature compensation. We believe, however, it would be a good practice to assure a real temperature of 2550 F in the spout.

The tensile strengths given in Table 2 were determined on specimens taken from 1.58x1.58x9.5-in. bars in the laboratories of the factory. The Brinell hardnesses were taken on samples from the centers of 4-in. cylinders. The same samples were used for the spectrographic determination of the residual magnesium, and of final sulphur. Table 2 does not show elongations (which have not been determined) but we believe them to be small, generally not exceeding 0.5 per cent.

The reason for the small elongations should be sought in the structure of the graphite. If we examine a sample from a relatively thin section, about 0.8 in. thick, we observe spheroids of graphite and a certain number of small black spots (a trained eye will find the small black spots in many photomicrographs reproduced in papers on nodular cast iron.)

These small black spots increase with the section

TABLE 3 — INFLUENCE OF RAW MATERIALS ON GRAPHITE TYPE PRODUCED

Test No.	Raw Materials	Melting Unit	Mg Treatment	Mg_{res} %	Sulphur, % Initial (S_i)	Sulphur, % Final (S_f)	Crab Graphite at Center of Sections 2.4 to 4 in. Thick
5D	hematite pig +	cupola	Mg-Ni	0.106	0.073	0.006	vermicular instead of crab
6D	semi hematite	cupola	Mg-Ni	0.059	0.073	0.007	mostly vermicular, little crab
7D	hematite, machine	cupola	Mg Si	0.053	0.077	0.009	abundant
8D	scrap, and steel	cupola	Mg Si	0.074	0.077	0.007	abundant
197	semi hematite	induction furnace	Mg Si	0.092	approx. 0.04	0.04	abundant
198	semi hematite	induction furnace	Mg-Si	0.071	approx. 0.04	0.023	abundant
199	+ armco iron	induction furnace	Mg Si	0.061	approx. 0.04	0.016	abundant
187	semi hematite	induction furnace	Mg Ni	0.062	0.03	0.007	abundant
188	semi hematite	induction furnace	Mg-Ni	0.088	0.03	0.006	abundant
189	semi hematite	induction furnace	Mg-Ni	0.122	0.03	0.009	very abundant
190	open hearth, steel scrap	induction furnace	Mg-Si	0.026	0.085	0.014	nil
192	+ electrode graphite,	induction furnace	Mg Si	0.041	0.085	0.012	nil
194	ferro-silicon, iron sulphide	induction furnace	Mg Si	0.075	0.085	0.011	nil
195	ferro-silicon, iron sulphide	induction furnace	Mg Si	0.079	0.085	0.010	nil

thickness of the casting (inversely with the speed of solidification). Starting with a given section the small black spot becomes either vermicular graphite or crab graphite, two varieties which Morrogh has indistinctly qualified as "quasi-flake graphite." These two forms clearly appear in the samples taken at the center of the 4-in. cylinders (Figs. 9 to 12). Figures 9 and 10 show the form and distribution of graphite at the center of castings 6D and 7D. Figures 11 and 12 show selected areas rich, respectively, in vermicular graphite and in crab graphite. These photomicrographs come from castings 5D and 8D.

The influence of crab graphite and of vermicular graphite on the mechanical properties of nodular cast iron (in which a significant part of the graphite occurs in the form of compact spheroids or even poorly formed nodules) can be expressed briefly as follows: The strength of the cast iron decreases as the percentage of the vermicular graphite or the crab graphite increases, but the strength remains high. The order of strength can be estimated roughly from Table 1.

Thus it appears, and this is confirmed by the observations of others, that a sudden increase in tensile strength is obtained as flake graphite is transformed to vermicular graphite. A second increase is obtained on passing from vermicular form to the quasi-perfect

TABLE 4 — HIGH-SILICON ALLOY ADDITIONS

Test No.	Addition Alloy, Si-Ni-Mg	Addition, %	Added Mg, % of iron wt.	Secondary Inoculation, % (90% Fe-Si)
190	10% Mg	3.0	0.30	0.6
191	10% Mg	2.0	0.20	0.6
192	15% Mg	2.5	0.375	0.6
193	15% Mg	1.7	0.255	0.6
194	10% Mg	3.0	0.30	0.6
195	15% Mg	2.0	0.30	0.6

sphere. Hence, contrary to what might be supposed from Figs. 11 and 12, the effect of notching of the vermicular graphite and the crab graphite is not as important as the influence of the flake graphite.

Concerning elongation, however, according to our tests vermicular graphite and crab graphite seem to have a more important influence. We have stated that with the appearance of a more or less important proportion of vermicular graphite or crab graphite the elongation falls below 0.5 per cent, and sometimes becomes negligible. On the other hand, a cast iron with almost completely spheroidal graphite has an elongation which exceeds 4 per cent in the case of a completely pearlitic matrix (Fig. 15) and can reach much higher values as the proportion of ferrite in the matrix increases.

Influence of Graphite Form

If we compare the elongation (practically negligible) of a cast iron with flake graphite to that (0.2 per cent) of a nodular cast iron including beside the spheroids a certain proportion of vermicular graphite or crab graphite, and finally the elongation (about 4 per cent) of a cast iron with almost completely spheroidal graphite and a pearlitic matrix, the influence of the form of graphite on the elongation appears to be of the same order as its influence on the strength.

Vermicular graphite and crab graphite seem to be

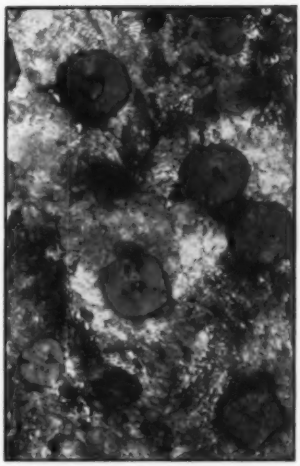

Fig. 13 — Test No. 192 — This specimen of nodular cast iron has a completely pearlitic matrix. Refer to Fig. 2 for graphite form and distribution. Benedicks etch. X250.

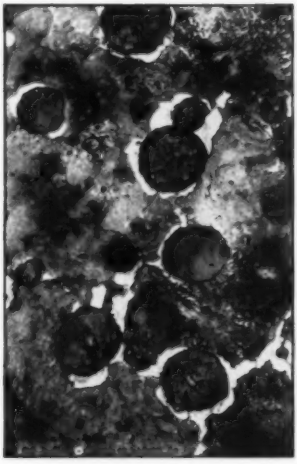

Fig. 14 — Test No. 194 — Some ferrite appears in the pearlitic matrix of this nodular iron specimen. Benedicks etch. X250.

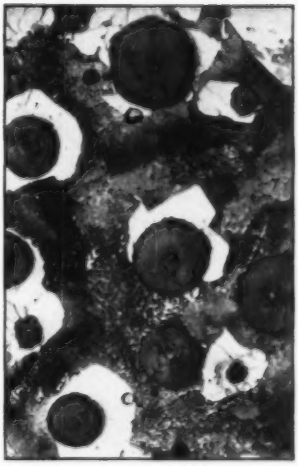

Fig. 15 — Test No. 195 — An increased amount of ferrite is shown in the essentially pearlitic matrix of this nodular cast iron. Benedicks etch. X250.

Fig. 16 — Test No. 170 — The as-cast structure of this nodular iron has a matrix of about 90 per cent ferrite and 10 per cent pearlite. Nital etch. X300.

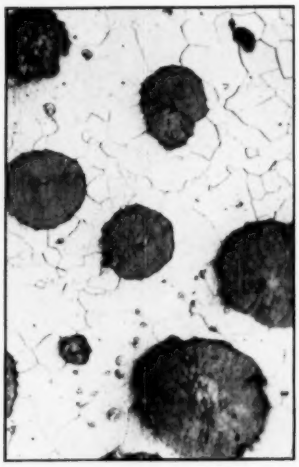

Fig. 17 — Test No. 89 — The ferritized structure of this nodular iron, similar to that of Fig. 16, was obtained by heat treatment. Nital etch. X300

much more usual in treatments with cerium and lithium than with magnesium. For the magnesium treatment this form of graphite is not peculiar to industrial cupola melting. Many heats in the laboratory induction furnace (maximum capacity 25 to 33 lb of iron) followed by magnesium treatment have given exactly the same forms of graphite for 100 per cent charges of semi-hematite pig. Another type of hematite pig, on the contrary, seems to be much more favorable for the production of almost completely spheroidal graphite.

Synthetic cast irons produced from commercially pure iron have been shown to be equally subject to production of crab graphite. It is interesting that this iron had been produced in a small induction furnace by melting steel scrap under oxidizing conditions, deoxidizing with silicon (avoiding a residual silicon greater than 0.03 per cent), and finally deoxidizing with aluminum. This iron had an analysis in which the total of carbon, silicon, manganese, phosphorus, and sulphur did not exceed 0.12 per cent.

The synthetic cast iron produced in the induction furnace from open hearth steel scrap gave the best and the most regular results (Table 3 and Figs. 13-17). This conclusion is based on more than 40 tests.

Table 3 illustrates the influence of raw materials. Study of this table does not indicate a relation between crab graphite and any important variable except perhaps the raw materials.

Relatively light alloys of the series Si-Ni-Mg were used in one set of laboratory tests. Raw materials used for the base iron were open hearth steel scrap, ferrosilicon, electrode graphite, and iron sulphide. The sulphur content of the available steel scrap was only 0.036 per cent, so to produce a fluid iron of 0.08-0.09 per cent sulphur we made an addition of 0.25 per cent of iron sulphide. Sulphur recovery was uniform, varying between 21 and 22 per cent.

The tests were made on about 13 lb iron treated as follows: No. 190-193—magnesium alloy added as sized grains in the stream where it enters the ladle; No. 194-195—small pieces put directly into ladle. Amounts added are given in Table 4.

Minimum Additions and Recoveries

Four of the six tests gave good results; the other two, 191 and 193, where the addition of the magnesium alloy was intentionally reduced to a minimum, could only succeed if a particularly high recovery were obtained. This was rather low in test No. 193 and normal in test No. 191. The principal results of tests 190-195 are given in Table 5.

It is interesting to note that the residual magnesium is extremely low in cast irons 191 and 193, showing that the failure of the treatment must be ascribed to an insufficient addition of magnesium alloy. If we compare the recoveries of the different magnesium alloys (Tables 2 and 5) it is clear that the alloys with high nickel contents are superior to those of the lighter alloys containing much silicon.

In using nickel-rich alloys, nickel is incorporated in increasing quantity with successive meltings of foundry returns, which might seem to lead to excessive nickel contents, but this is not the case. The theoretical maximum which can be obtained in operations using 33 per cent foundry returns and 1.5 per cent of an alloy containing 80 per cent nickel (giving a value to X of 1.2) is given by the geometric progression:

TABLE 5 — EFFECT OF Ni-Si-Mg ALLOY ADDITIONS ON PHYSICAL PROPERTIES

Test No.	Final Composition, % C	Si	Mn	P	Ni	S_2	Mg_{res}	Efficiency, %	Modulus Elasticity, % × 10^6	Tensile Strength, 1000 psi	Elongation %	Brinell Hardness
190	3.26	1.87	0.63	0.02	0.36	0.014	0.026	29.0	—	100.3	2.8	242
191	3.29	2.12	0.71	0.02	0.25	0.022	0.009	28.5	—	—	—	—
192	3.40	1.90	0.65	0.02	0.37	0.012	0.041	27.5	—	106.9	4.1	242
193	3.16	2.22	0.67	0.02	0.20	0.030	0.015	22.5	—	—	—	—
194	3.38	2.27	0.67	0.02	0.37	0.011	0.075	45.0	25	106.7	4.0	242
195	3.29	2.30	0.65	0.02	0.25	0.010	0.079	37.0	25	102.8	5.6	242

Per cent Ni = X $(1 + 1/3 + 1/3^2 + \ldots 1/3^n)$
or, for X = 0.8 × 1.5 = 1.20 per cent and n = ∞

Per cent Ni = $1.2 \frac{1}{1-1/3} = 1.8$ per cent.

Such a nickel content can only be favorable. On the other hand, treatment with alloys rich in silicon is more economical and permits using a base iron of very low silicon content, which can be obtained very economically from a charge consisting of 60 per cent steel.

The structure of the cast irons 192, 194, and 195 appears in Figs. 2, 13, 14, and 15. Figure 2 shows the general distribution and the form of the graphite in cast iron 192, and is representative of the other three castings. These three castings give practically the same results, the slightly inferior strength and the superior elongation of cast iron 195 resulting only from the fact that the matrix is composed of pearlite and an appreciable percentage of ferrite.

The relationship between the structures of the three cast irons appearing in Figs. 13, 14 and 15, and the properties given in the Table 5 is significant. Note that as the ferrite increases with decreasing pearlite, the strength decreases and the ductility increases.

It seems to be possible to obtain a ferritic matrix as cast. For such a structure and wholly spheroidal graphite, the elongation should reach 15 to 20 per cent. Figure 16 shows the structure of a nodular cast iron whose matrix is about 90 per cent ferrite and 10 per cent pearlite in islets dispersed in areas low in graphite nodules. It is interesting to compare the structure with that of a nodular cast iron ferritized by heat treatment. Figure 17 is an example with a similar structure and shows an iron with a tensile strength of about 71,000 psi, a Brinell hardness of 150 to 160, and an elongation (test bar L. = 4D) greater than 20 per cent.

Acknowledgments

The author wishes to express his appreciation to the directors of IRSIA, Fabrimetal, and the many manufacturers for their financial support and confident and understanding attitude; to his collaborators for their initiative and devotion; to those who have given the benefit of research and valuable practical advice; to the Mond Nickel Co. for supplying the standards for spectrochemical analysis of magnesium in cast iron; and especially to the president and scientific commission of the Belgian Foundrymen's Society.

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A.F.S. RESEARCH PROJECTS

Research projects of A.F.S. are conducted under definitive contracts with various institutions which have the necessary personnel and mechanical facilities. Reports on each project are required at regular intervals.

"Research" is just that—*search* and *re-search*. It is not like production where reasonably well-known materials, proved methods and engineered designs are employed to turn out salable products. Research commences with an idea and many unknown factors, all of which must be examined by trial and error before the actual idea itself can even be approached.

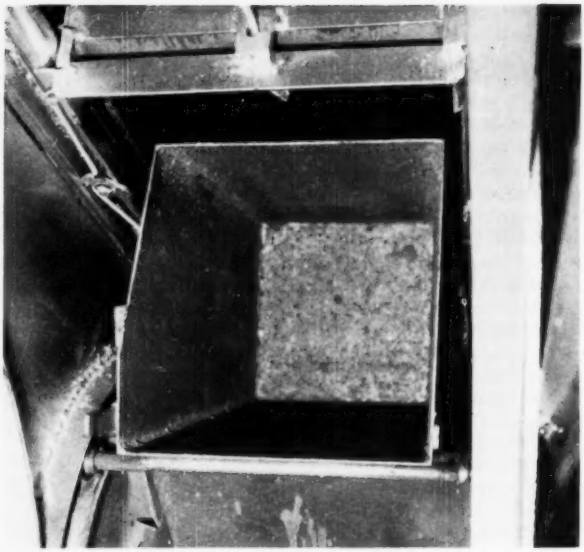
Results of A.F.S.-sponsored research, when in publishable form, are available to everyone. Quarterly progress reports and visits and consultation with the researchers keep the committees directing the work informed on project developments. Annual reports on the various researches under Society sponsorship will become a regular feature of the Annual A.F.S. Convention.

Title of Project	Group Directing Work	Institution
Hydraulics of Light Metal Flow into Molds	Research Committee, Aluminum and Magnesium Division	Battelle Memorial Institute
Fracture Test as an Index of Melt Quality	Research Committee, Brass and Bronze Division	University of Michigan
Centrifugal Casting of Light Metal Alloys	Centrifugal Casting Committee, Aluminum and Magnesium Division	Canadian Bureau of Mines
Influence of Heredity on Coke Behavior in the Cupola	Cupola Research Committee	U. S. and Canadian Bureaus of Mines, Ford Motor Co., and Eaton Mfg. Co.
Fundamentals of Heat Flow During Casting Solidification	Heat Transfer Committee	Columbia University
Second Project Under Consideration	Research Committee, Malleable Division	
High Temperature Properties of Molding Sands	Research Committee, Sand Division	Cornell University
Relation of Cores to Hot Tearing	Research Committee, Steel Division	Armour Research Foundation
Risering of Gray Iron	Research Committee, Gray Iron Division	Massachusetts Institute of Technology

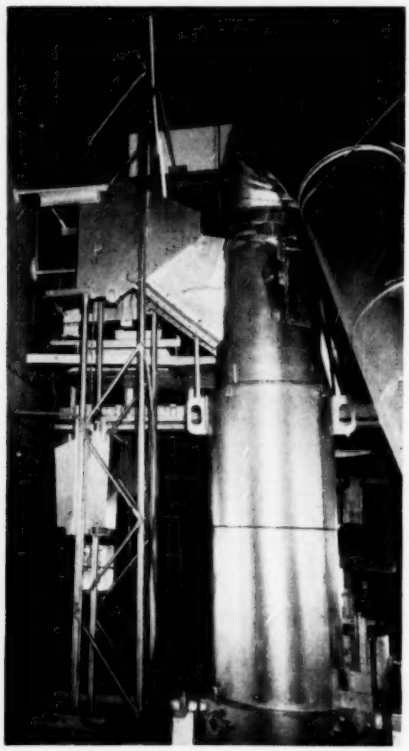
A SMALL SKIP HOIST for mechanical cupola charging has been designed and constructed by University of Wisconsin students for use in the metal casting laboratory. In describing the installation, N. J. Stickney, instructor in metallurgy, considered that "The project itself was worthwhile in acquainting the students with some of the problems of mechanical cupola charging."

The capacity of the skip hoist is 150 lb or 1.4 cu ft. A low hoisting rate (27 fpm) was found to be satisfactory and safe for student operation. The hoisting weight was intentionally limited to 150 lb to prevent accidental overcharging by students, but can readily be increased.

During the charging operation the loaded bucket is raised vertically to the level of the charging door where the dumping action begins. Dumping wheels attached to the sides of the bucket engage in dumping rails and tilt the bucket over a charging door chute as the bottom is raised to dump the charge. An electrical limit switch prevents further rise after the charge is dumped.



STUDENTS CONSTRUCT LABORATORY SKIP HOIST FOR UNIVERSITY OF WISCONSIN FOUNDRY CUPOLA



◀ *A general view of the cupola showing the hoist structure, bucket, guides, bail, and charging chute. At the right is the 16-in. I.D. downcomer for stack emission control, described in* AMERICAN FOUNDRYMAN, *Aug., 1949, p. 49.*

▲ *The bucket dumping wheels are engaged in the dumping rails, and the bucket is partially tilted out of the bail. At the left of the bucket is the safety "dog" which prevents tipping of the bucket until the dump wheels engage.*

The bucket is suspended within a bail or carriage which slides between two vertical guides. A cable, attached to the bail, passes through an overhead pulley and is wound on a 6-in. drum driven by a worm gear speed reducer powered by a 0.5 hp, 865 rpm, 220 volt A.C. motor. The drive assembly is mounted on a platform at the charging door level to allow additional floor space adjacent to the cupola. The platform also serves as a working deck for checking bed height, and for other jobs.

The bucket and chute are constructed of $\frac{1}{8}$-in. steel plate, the dumping rails of steel strap welded to $\frac{1}{4}$-in. steel plate, the bail of angle iron, and the guides and reinforcing members of $1\frac{1}{2}$ and $\frac{1}{2}$-in. pipe.

NEW A.F.S. PINS AVAILABLE

New membership pins bearing the legend "A.F.S.", replacing the now-outmoded "A.F.A." pins, are available. New membership pins are available at $1 each from A.F.S. Headquarters or will be exchanged for old pins.

MECHANIZE SAND CONDITIONING AND DISTRIBUTION SYSTEM AT OHIO STATE

John W. Anibal
Assistant, Foundry Laboratory
Ohio State University
Columbus, Ohio

THE EXPANSION AND MODERNIZATION PROGRAM in progress at the foundry laboratory of Ohio State University includes a sand-conditioning and distribution system. The necessity of such additional laboratory facilities became apparent in 1947 when the foundry option in industrial engineering was developed[1].

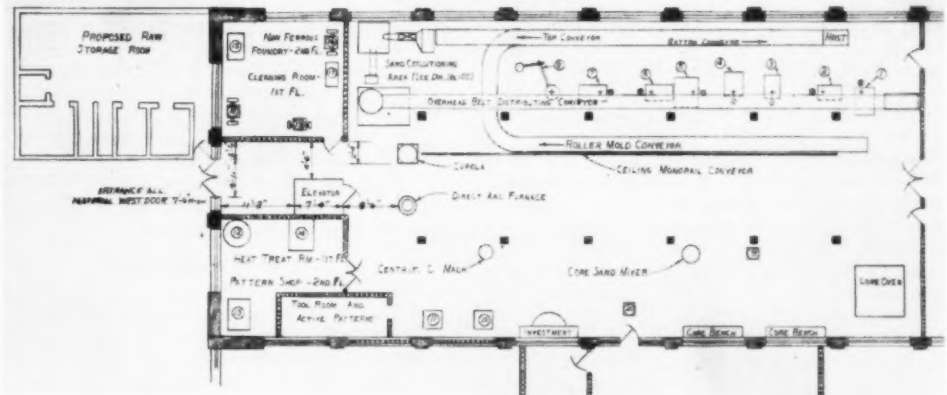
Although Ohio State has had a good foundry laboratory for half a century, only during the past 25 years has it been operated in the department of industrial engineering. To meet the requirements established by the new curriculum, an entire new layout was planned, with many new areas of instruction.

The only new floor space obtained will be used for the control laboratory, but a raw material storage shed is proposed. The control laboratory is to be complete with sand, metallographic, chemical, and physical testing equipment. The new heat-treating room, pattern shop, cleaning room, and non-ferrous foundry will be located in rooms now used for raw material storage. Sufficient room for increasing the coremaking area, and space for centrifugal, investment, and die casting apparatus, and for future expansion, is made available by placing the sand distribution system and molding machines in the north bay of the laboratory (Fig. 1).

In addition to allowing for economical utilization of space, the new sand installation has noteworthy academic justification. It will be of tremendous value in demonstrating to students in engineering the fundamentals of modern foundry practice, the use of model equipment, and the opportunities offered by the industry. Modern laboratory facilities are essential to foundry-option courses, especially for students doing theses on foundry problems.

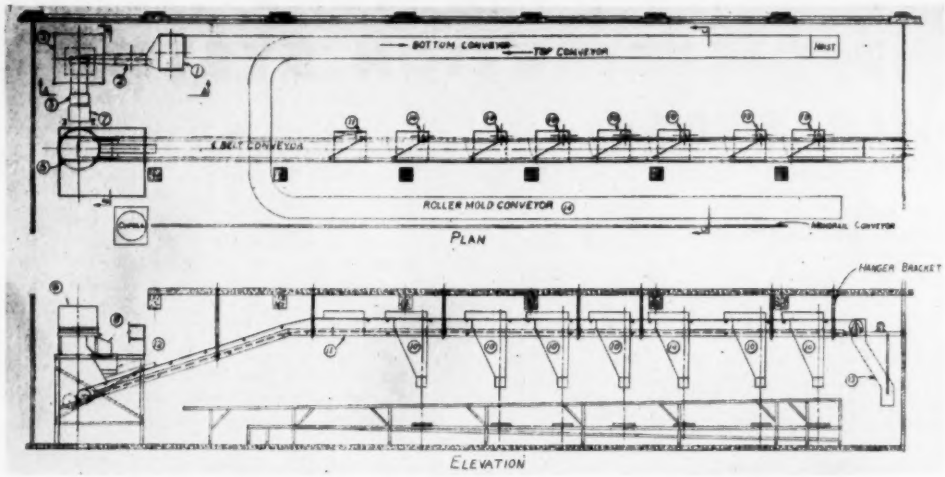
Returning to the design and operational procedure of the unit, it is stressed that this equipment is a laboratory tool, not an industrial situation. Like many industrial material-handling systems, Ohio State's layout has been designed for an existing building. The fixed conditions within this building are the present cupola location and the fact that only one two-story bay is available to obtain the required height for storage and sand conditioning equipment.

Because of these two restrictions, the best device



1. Jolt rollover pattern draw
2. Jolt pin lift
3. Jolt squeeze pin lift
4. Jolt squeeze
5. Squeeze
6. Jolt squeeze
7. Squeeze vibrator
8. Sandslinger
9. Jolt hand rollover
10. Die casting machine
11. Die casting machine
12. Heat treat furnace
13. Heat treat furnace
14. Heat treat furnace
15. Airless blast cleaning
16. Grinding stand
17. Shotblast cabinet
18. Grinding stand
19. Grinding stand
20. Core blower

Fig. 1—Schematic layout of the Ohio State University foundry laboratory.



1. Shakeout
2. Bucket elevator
3. Sand storage bin
4. Vibrating feeder
5. Screening and magnetic separating
6. Mixer
7. Bucket loader
8. Aerator
9. Distributing belt conveyor
10. Molder's hopper and swing plow
11. Chute and swing plow
12. Loading chute
13. Overflow chute
14. Roller mold conveyor

Fig. 2—Sand conditioning and distribution layout.

seemed to be a U-shaped mold conveyor layout (Fig. 2). This is flexible and compact, with room for an overhead sand distribution belt and eight molders' stations inside the U. To obtain sufficient solidification travel, based on experiments with roller conveyor pouring in the laboratory, the conveyor leg running nearest the wall is to be double-decked. This arrangement also provides a convenient return path to the shakeout and conditioning equipment which is located in the same end of the building as the pouring station, near the cupola.

Space limitation in the sand conditioning bay (19 x 19 ft) constitutes a major problem in that it must accommodate the following equipment: shakeout, shakeout and elevator pit, bucket elevator, sand storage bin, vibrating feeder, magnetic separating and screening unit, skip hoist, muller and muller platform, aerator, and the 20-in. distribution belt take-up.

To trace through the process briefly, assume that the sand is already in one of the molder's hoppers (10, Fig. 2) and a mold made. The mold is placed on the horizontal roller conveyor (14) and pushed to the conveyor turn nearest the cupola for pouring. The mold with solidifying metal is then rolled to the wall and moved onto the bottom level of the double-decked gravity conveyor to travel 60 ft to the mold hoist. It is then raised to the top level and returned 70 ft by gravity to the shakeout (1). The casting is hooked and transported to the cleaning room.

The sand falls into the elevator intake chute to be lifted from the pit by the bucket elevator (2) and discharged into the storage bin (3). Upon demand sand for preparation is fed from the bin by the vibrating feeder (4) into a screening and magnetic separating unit (5) and subsequently discharged into the muller skip hoist (7). With a mixing cycle completed, the muller (6) is emptied into an aerator and the sand loaded onto the 20-in. sand distribution belt (12) to be carried up the incline and swept from the belt by single-blade plows into the molders' hoppers.

Modernization of the Ohio State foundry laboratory is the logical consequence of the university's interest in promoting foundry science at the engineering level[2]. Its foundry-mindedness, its consciousness of the need for training in the foundry field, comes in recognition of the desires of a considerable portion of the state's foundry industry, and the long-range program of the Foundry Educational Foundation.

Acknowledgments

The original schematic layout of the foundry laboratory was prepared by the National Engineering Co., Chicago. In the preparation of the engineering design of the system, the student co-designers, R. E. Sessions, Paul Pritchard, Dan Carruthers, Earl Smith, Wm. Dundon, and the author, were advised and assisted by the C. O. Bartlett & Snow Co., Cleveland, who will also supervise construction of the system. The expansion program would not have been possible without the generous support given by the equipment manufacturers and suppliers.

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Operation Tulsa . . .
Joint Educational Program Trains Foundrymen

J. A. Dean, Manager
NEMCO Foundry
Tulsa, Okla.

WM. D. KNUDSEN ONCE STATED: "The good mechanic must be a thinker. Often he might be a slower thinker than the fellow who is a wizard at passing college examinations, but best of all is the man who combines the learning of books with the learning which comes of doing things with the hands. The young man who has that combination need not worry about getting along in the world today, or at anytime. The time is coming, also, when there will have to be an immense program of renovating and modernizing and rebuilding of America's productive machinery. When that gets under way you will see a great demand for skilled mechanics, a demand greater than the present supply."

Laid Groundwork Two Years Ago

With this in mind the foundry industry in Tulsa with an equal representation of management and labor, together with the counsel of the local field representative of the Bureau of Apprenticeship, U. S. Department of Labor, formed the Tulsa Molders' Joint Apprenticeship Committee in February, 1947. This committee established apprentice standards and in July, 1947, fourteen apprentices were indentured to the committee. The committee had its problems and taking a realistic view of them, and with honest effort, was able to solve many of them. By holding regular meetings, better understanding between the employers and employees was obtained through a sincere effort to understand the problems and to promote the welfare of the foundry industry.

The foundry industry today is faced with enlarged responsibilities. Demands from manufacturers, as well as competition, have forced the industry to make a better product, which makes it necessary for each foundry employee to be as highly skilled as possible—also he must understand the problems of the various groups involved in foundry production.

This problem can be solved through extended education of foundry employees as a whole—not just the apprentices, who represent a minority of the foundry workers. This does not mean apprenticeship related training should be side-tracked, but that the program be expanded to include all workers from the helper to the supervisor.

In January, 1950, with the information and experience gained through months of discussion and experimentation, as well as contacts with most all the foundries in the Tulsa area—together with the counsel of the local field representative—the Joint Apprenticeship Committee was reorganized and the name was changed to Foundry Education and Apprenticeship Committee. The purposes established were three-fold:

—To create an active interest between management and labor in foundry education.
—To promote and perpetuate sound apprenticeship practices in all phases of foundry production.
—To promote the idea that "The Foundry is a *Good* Place to Work."

From the past we know that skilled mechanics must learn while they work. This calls for working at the trade each day with trade studies supplementing the work experience.

To secure adequate and organized supplementary training, the reorganized committee contacted the Tulsa Public School officials and asked that an educational program be set up. With the aid of this public school service, administration and supervision of the class room program was possible. Facilities were also made available. The following topics selected by the committee are included in the related instruction program to be completed during a four year period.

1. Sand and Sand Control
2. Core Making and Dry Sand Molding

(Continued on Page 133)

Group attending the sand and sand control phase of the Tulsa educational program. In the front row, starting third from left, are: the author, J. A. Dean, NEMCO Foundry, Tulsa, chairman of the committee sponsoring the meetings; Guest Speaker William Peterson, M. A. Bell Co., St. Louis; Fred Havens, course instructor; and Ben P. Glover, M. A. Bell Co., St. Louis.

MALLEABLE IRON ANNEALABILITY

excess oxidation effect in cupola melting

Milton Tilley
Metallurgist
National Malleable & Steel Castings Co.
Cleveland

MANY MALLEABLE IRON METALLURGISTS are content to accept the idea that oxides and/or the effect of oxidation in their metal is of no consequence because of the presence of a high percentage of carbon and silicon. In recent years this phase has come under closer scrutiny, particularly with respect to the effect on graphitization.

Every metallurgist has heard about the "old timers" experiencing periods when the metal became progressively harder to handle both as to castability and annealability. No matter what they did, misruns, shrinks and hot tears were out of control, and the annealing rejections were high due to pearlite.

When the condition became intolerable they eliminated the returns from the charge, substituted purchased scrap, and used a high percentage of pig iron, thereby making a heat of so-called "virgin metal." Also, when the melting operations got out of control so that a heat became badly oxidized, a small quantity of aluminum would be added.

Most metallurgists have had the experience of a particular heat giving trouble in the foundry and annealing or, in the case of continuous melting, one period during the day resulting in increased foundry losses due to misruns, shrinks and hot tears, and annealing rejections due to pearlite. In a large percentage of such cases the trouble was a result of excessive oxidation during melting. Obviously, the same condition can be arrived at by introducing a large percentage of excessively scaled scrap.

It is well known that excessively oxidized metal freezes at a higher temperature than normal metal, resulting in increased misrun loss. Also, that it has higher shrinkage, with consequent hot tear increase.

NOTE: This paper was presented at the Ohio Regional Foundry Conference, sponsored by the A.F.S. Ohio Chapters, in Cincinnati, Mar. 10-11, 1950.

However, it is not so well known how to evaluate the severity of oxidation with respect to graphitization rates. A partial answer, and it well may be a complete one, is that the number of graphite nodules is reduced with increasing percentages of oxidation, especially when the rate of oxidation exceeds that established in normal operation.

It has been demonstrated by Schwartz and others that the distance between nodules, through which the carbon travels in the graphitizing process, is one measure of graphitization rate.

Figure 1 shows the correlation between percentage oxidation of the silicon charged and the nodule count per cubic millimeter and the resultant iron as manufactured in the cupola-air furnace duplex unit in the author's plant. The long line of regression represents the correlation of all the data.

By visual inspection it appeared that there was a possibility of two universes, one below 26 per cent oxidation and one above 25 per cent. Accordingly, regression lines were calculated for each, with the result shown. They suggest that the true line may be curvilinear with increasing effect with increasing percentage of oxidation, particularly above 25 per cent which is normal for our melting unit. Our normal

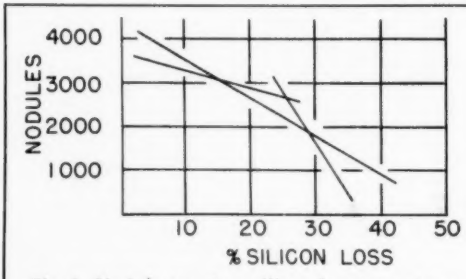


Fig. 1—Nodule count vs. silicon loss percentages.

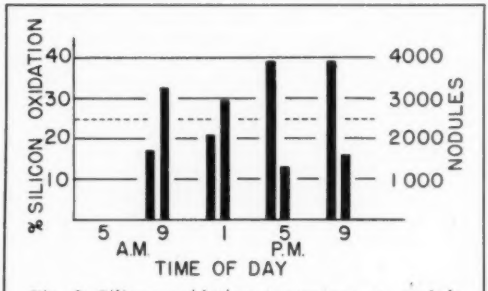


Fig. 2—Silicon oxidation percentage vs. nodule count; 14 per cent of castings had white edges (not fully annealed and would be difficult to machine).

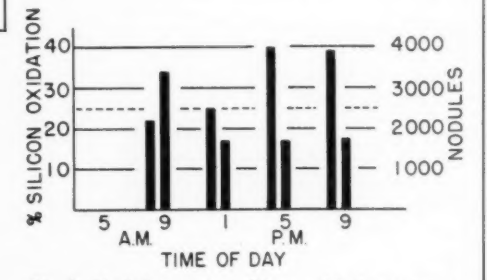
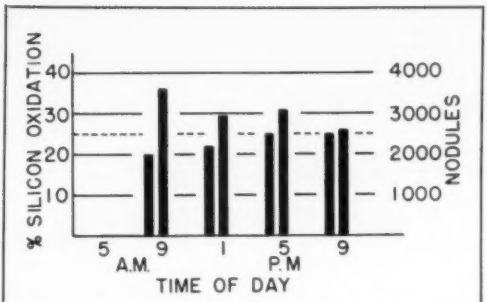
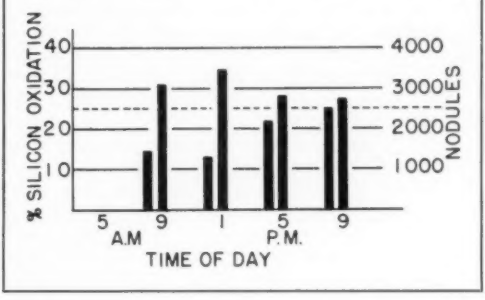


Fig. 3—Nodule count vs. silicon oxidation percentages; 6 per cent of the castings had white edges.



Figs. 4 (above) and 5 (below) show the effects of silicon oxidation rates of 25 per cent and under on nodule count (no rejection after anneal).



nodule count is 2500, and by inspection it is seen that the regression line passes near this point.

The illuminating information derived is that it requires but 6 or 7 per cent oxidation of the silicon charged over normal to reduce the average nodule count by one half, which in turn reduces the graphitization rate to an alarming extent. At 35 per cent oxidation of the silicon charged the nodules are reduced to the point where the time required to break up the last of the pearlite is longer than is commercially economical.

The data were obtained by calculating the silicon loss from the amount in the charge and the analysis of the air-furnace iron at the time the test piece was poured. All test pieces, designed to duplicate the ASTM test bar in as-cast cooling rate, were annealed in a closely controlled laboratory furnace, using the same heat cycle and controlled atmosphere. Seventy-two samples were acquired over a period of 10 months.

To illustrate the relation, Figs. 2, 3, 4 and 5 were prepared, in which the effect of oxidation on the nodule count on daily test bars, poured at 9:00 a.m., 1:00 p.m., 5:00 p.m. and 9:00 p.m., is depicted for those particular days. The columns on the left show the calculated oxidation rate, and those on the right the nodule count.

Figure 2 was constructed because a 14 per cent rejection was indicated by our quality control method of examining 100 representative test lugs each day, using dated castings. The chart shows the trend but did not show the severest effect where a nodule count of as low as 100 was found in castings.

Figure 3 was developed because at 4:00 p.m. a very severe oxidizing condition was encountered due to a "bridge over" in the cupola. Operations were stopped and a heavy addition of ferrosilicon was added to the air furnace. All affected iron was held separate through the anneal, and no rejection was encountered. However, on the other iron not receiving the extra heavy treatment with ferrosilicon, 6 per cent rejection was indicated.

This experience is presented to call attention to the effect of deoxidation which is known to alleviate the detrimental effect of overoxidation. It has been demonstrated that it restores, at least in part, the number of nodules. It may be well to point out here that deoxidation can be overdone with attending loss in fluidity, poor sulphide form, and the formation of primary graphite.

Figures 4 and 5 are presented to show the effect on nodule count of melting conditions of 25 per cent and under oxidation of silicon. On these days no rejection after anneal was encountered.

This information indicates that malleable iron foundry castability and annealing troubles would be alleviated if oxidizing conditions during melting were more closely controlled and, in case of inadvertent excessive oxidation, some steps were taken to properly deoxidize the metal before casting. It also suggests that a closer study of this phase would enlarge on our conception of the formation of "spores" and mechanism of graphitization.

For those who may contemplate checking these results or enlarging upon them it should be borne in mind that the standard deviation is relatively large, necessitating a fair number of tests to avoid the possibility of obtaining misleading results.

Award A.F.S. 50-Year Service Pins To Nine Canadian Westinghouse Men

NEW A.F.S. 50-YEAR SERVICE PINS were recently presented with the compliments of the Society to nine employees of Canadian Westinghouse, Ltd., Hamilton, Ont., whose total years of service to the foundry industry number more than 450 years.

Oldest employee in point of service is Foreman Floor Molder W. Robinson, who began his apprenticeship with Furnibal Brothers, Lancashire, England, in 1896. Tied for second place in years' service are Bench Molder A. Lockhart, who began as an apprentice with Abbott's Foundry Co., Falkirk, Scotland, in 1898; Robert Plenderleith, who was apprenticed with Carmir Foundry Co., Camelon, Scotland; and B. Zinger, who was apprenticed in 1898 with Acme Malleable Iron Foundries, Black Rock, N. Y.

Canadian Westinghouse employees who began their foundry careers in 1899 are:

Coremaker J. Weir, apprenticed to Carron Iron Works, Ltd., Falkirk, Scotland; Coremaker W. Bennetts, who was apprenticed to Ormond Brothers, Cainborne, England; Metal Patternmaker J. Caldwell, apprenticed to Butterworth Foundry Co., Ottawa, Ont.; and Molder D. Waddington, apprenticed to Wilson and Mathieson Foundry, Armley, England.

"Youngster" among 50-year pin recipients is Wood Patternmaker A. Pitts, who began with Goldie-McCulloch Co., Galt, Ont., in 1900.

Chicago's Lane Tech

HIGH SCHOOL BENEFITS FROM CHAPTER-TEACHER COOPERATION

Howard W. Smith
Supervisor of Foundry
Vocational Education Dept.
Chicago Board of Education

MODERN FOUNDRY TECHNIQUES, taught in well-equipped shops and laboratories, are an outstanding feature of the curriculum of Lane Technical High School, whose enrollment of nearly 5,000 students makes it Chicago's largest high school. Fully accredited, Lane owes much of the excellence of its foundry curriculum to a willingness on the part of its instructors to keep abreast of latest developments in casting techniques and equipment.

Chicago Chapter Aids Education

The A.F.S. Chicago Chapter has been extremely active in providing a liaison between education and industry by presenting the school's instructors with memberships in the American Foundrymen's Society—a practice which enables these instructors to hear many of the nation's foremost authorities on various phases of the foundry industry discuss the most up-to-date castings developments and practices.

The administrators and teaching staff of Lane Tech regard founding as one of the basic industries and in counseling students on their studies and future plans, stress the importance of the foundry as a good place to work, and emphasize the industry's value to the national economy.

Core curriculum and sequences required for graduation from Lane Technical High School are the same as those required by all other high schools in Chicago and students desiring shop work or technical knowledge in conjunction with this curriculum attend Lane from all over Chicago's North Side. Graduates are not only eligible for entrance into engineering schools throughout the country, but by selecting proper elective courses offered may enter other college courses. Shop courses are offered in foundry, heat treating, welding, forge, automobile, machine, aviation, air conditioning, pattern, wood, plastics, and the printing trades.

The Lane student elects foundry as his second year shop. This course is divided into three parts: (1) Foundry Practice—molding, coremaking, furnace preparation, operation, melting and mixing of metals; (2) Related Metallurgy and Information—source, distinction and purpose of materials, use and possibilities of basic and alloyed metals, fuels and their specific uses; (3) Finishing—finishing castings of all types made in the school foundry.

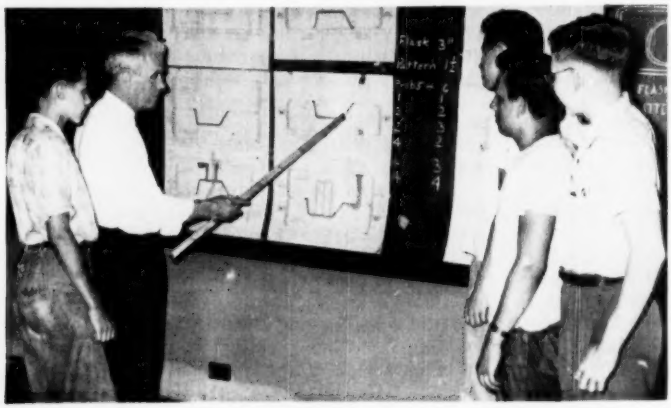
Foundry practice is broken down into fundamentals and when the student has mastered each an additional operation is added. This method is repeated until the student has covered all basic operations.

Shop Operated On Foundry Lines

Whenever possible the shop is operated on the same lines as a foundry. Students are selected to fill such positions as shop foreman, melting assistant, tool room assistant, roustabout, and safety assistant.

Safety is stressed in all shop operations and the student assistant is encouraged to bring to the instructor's attention conditions that do not make for safe foundry practices.

The roustabout does such odd jobs as cleaning up



Instructor Lawrence Sutherland explains a classroom molding problem to foundry students of Chicago's Lane Technical High School. Lane's 4,880 students, all boys from Chicago's North side, learn the fundamentals of sand preparation, molding and coremaking techniques.

after a heat, keeping shovels in condition, etc., and while responsible to the foreman, may be requested by the safety man to remove safety hazards.

The tool room attendant checks tools and patterns in and out, keeps the tool room in order, and reports loss or breakage of tools and patterns.

The melting assistant has charge of melting and aids in pouring of molds. At the same time, the safety assistant makes sure that all precautions are taken during these operations.

The foreman's duties include seeing that students have necessary flasks and equipment, giving molds a preliminary check before instructor is called in for approval, and ensuring that gangways are kept clean.

Shop Follows Through on Class Teachings

Foundry classes at Lane Tech are divided into classroom and shop work, with classroom lectures serving concurrently as preparation for shop assignments.

Shop work includes 22 basic foundry operations, use of nails, using and drawing matchplates, using slick in coping down, cutting multiple gates, rapping pattern through the cope, loose parts in patterns, risers, shrinkage, false cope, plaster matchplates, oil matchplates, use of soldiers, nails, gaggers, chaplets and burlap; attached gates, strainer core in sprue and gate, runner and branch gates, mixing binders, baking; venting, plastering and reinforcing, double parting, double roll, cheeks and headers, vertical molding methods, use of clamps

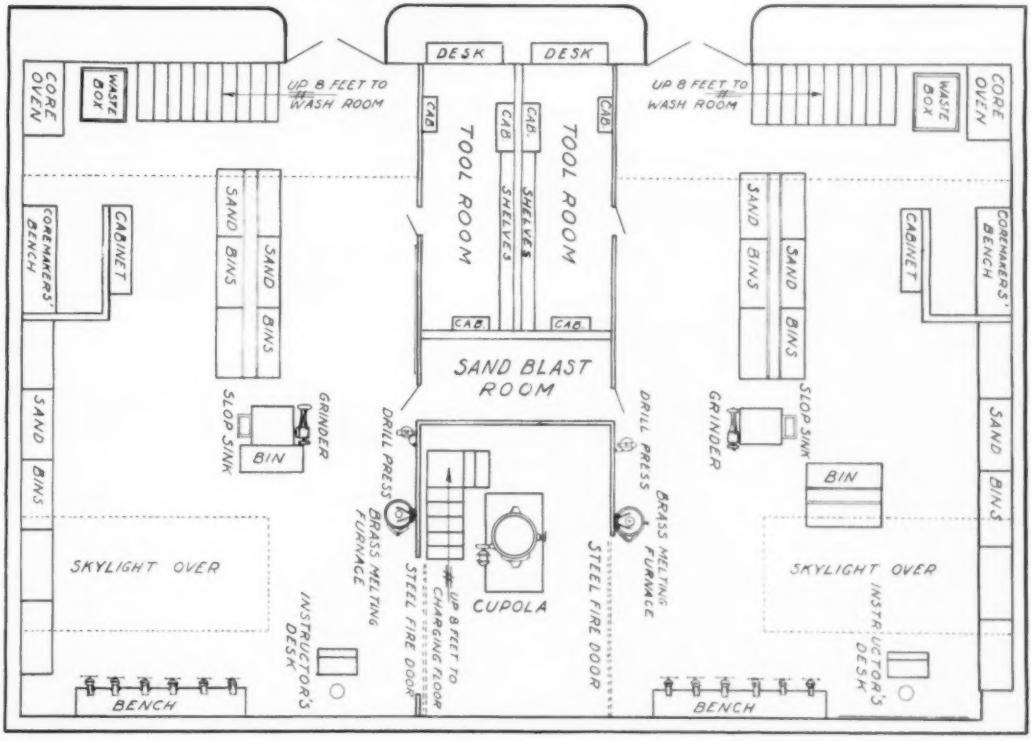
Lane Tech students learning basic molding technique.

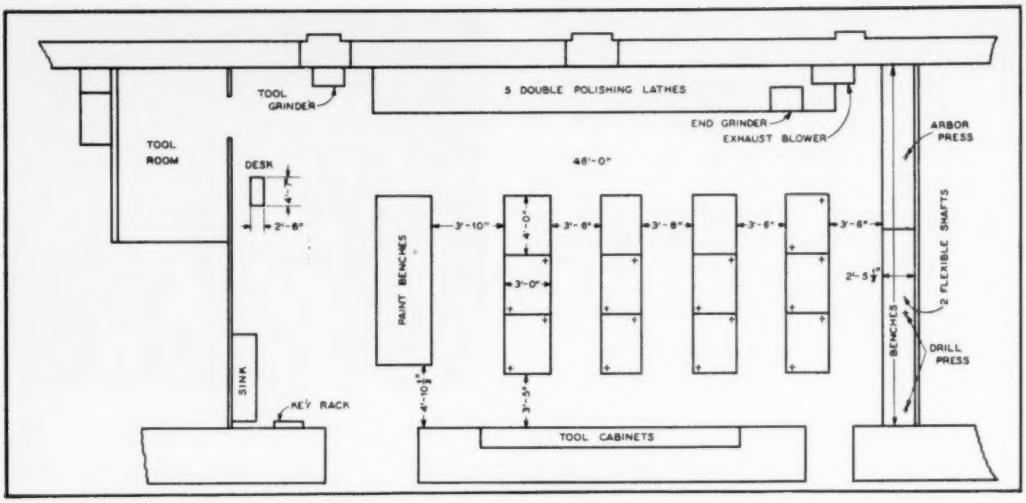
in rollover, handling of heavy work, floor ramming, and built-in cores.

Patterns molded in the Lane Tech foundry shops include simple flatbacks, leaves, two- and three-blade propellers, anvils, machine vises, engine blocks, small bathtubs, shell casings, flat sides, double sides, machine vise cores, fire irons, pulleys, gas engine pistons, and andirons.

A progress chart listing 10 required jobs and the

Overall floor plan of Lane Technical High School Foundry.





Floor plan of foundry finishing room at Lane Technical High School.

time needed to complete each, fundamentals learned and grade earned is given each student so that he can at all times evaluate his progress.

After the 10 required jobs have been completed, the student selects a pattern he would like to mold, and which he can finish and keep. There is a large assortment of patterns to choose from and popular choices vary from year to year. This year cooking utensils, house numbers and signs, school insignia, and boat hardware are in greatest demand. In past years, the foundry was at various times used as a source of cast-

Little space is wasted in school's molding floor.

Interested foundry students discuss molding problem.

ings for the machine shop but this practice was abandoned because it was felt that the school foundry became a production shop and its educational objectives were lost.

The selected castings made in the foundry are taken to the finishing room, which is equipped with grinders, buffers, and other finishing machines. Here, benches with all-position vises permit students to file, wire brush and finish their castings. After the casting has been finished to the instructor's satisfaction, the student is allowed to take it home. It has been found that this procedure not only encourages the student but helps sell the foundry to his parents and family.

Related metallurgy and information is taught in a regular classroom. Samples of molding, coremaking and castings are mounted on display boards about the

After completing his casting in Lane Tech's well-equipped finishing room, student can take it home.

room. This work is correlated as closely as possible with the foundry shop. Through this comprehensive combination of lecture and laboratory work the Lane student becomes familiar with the foundry.

Meeting in the office of Lane Principal James H. Smith last summer, members of the Chapter's Educational Committee and Chapter Chairman W. D. McMillan, International Harvester Corp., Chicago, presented memberships in the Chicago Chapter to the author and Foundry Instructors Thomas J. Brown, Fred H. Dix, Charles E. Roland, and L. L. Sutherland. These were the first of several such memberships that the Chapter plans to present to Chicago high school foundry instructors as part of a program designed to keep the foundry curricula of the city's high schools abreast of modern technology and equipment. The program is being carried out with the full approval of Dr. Hobart Sommers, vocational director of the Chicago Board of Education.

Plans are now being formulated by the Chicago Chapter's Educational Committee for the establishment of Junior Foundrymen's Society chapters in all Chicago high schools offering foundry courses, and for presentation of an annual award for the student submitting the best paper on some phase of the foundry industry. Eventually, the Committee hopes to establish similar competition between Chicago and other cities for the best student paper.

Members of the Chicago Chapter Educational Committee who are cooperating with Lane Tech and other Chicago high schools and vocational schools for the improvement of foundry education are: Roy W. Schroeder, University of Illinois, Navy Pier Branch, Chicago, chairman; E. E. Schwantes, International Harvester Co.; W. J. Hebard, Continental Foundry & Machine Co., East Chicago, Ind.; C. V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago; F. B. Skeates, Link-Belt Corp., Chicago; F. F. Shoemaker, Armour Research Foundation, Illinois Institute of Technology, Chicago; and A.F.S. Educational Division Chairman A. W. Gregg, Whiting Corp., Harvey, Ill.

FEF Issues Directory Of Students Available For Summer Foundry Work

QUALIFICATIONS of students from the nation's engineering schools and colleges who are interested in obtaining summer jobs in foundries are available in a booklet published by the Foundry Educational Foundation. Copies of the *Directory of Engineering Student Summer Work Applicants*, covering the period from June 15 to September 15, 1950, are available to interested foundry management from George K. Dreher, executive director, Foundry Educational Foundation, Terminal Tower Bldg., Cleveland, Ohio.

Classified in three sections—(1) Scholarship Students, holders of FEF scholarships, (2) Voluntary Students, engineers who have elected foundry sequence in FEF universities in addition to their regular curriculum, and (3) Regular Students, engineers in regular courses—the booklet contains names, addresses, previous work experience, education, marital status, age, etc., of each applicant, as well as a resumé of the student's occupational preferences and interests.

As part of the A.F.S. Chicago Chapter's new foundry educational project at the high school level, Chicago Chapter Chairman W. D. McMillan, International Harvester Co. (right) presents memberships in the American Foundrymen's Society to (starting left) Howard W. Smith, Supervisor of Foundry, Chicago Board of Education, and Foundry Instructors F. H. Dix, T. J. Brown and C. E. Roland of Lane Tech.

melted in a three-phase direct arc furnace; a gas fired crucible furnace was used for the aluminum alloy.

Following pouring of the molds on a roll conveyor line, they were shaken out with sand going to the conditioner and acrator before being returned to the molders.

The molding demonstrations illustrated the differences between hand molding and machine molding methods using jolt-squeeze and jolt-roll over-pattern draw machines. A loose two piece pattern for hand molding and plated patterns for machine work brought out the advantages of modern methods on high production runs. Various types of flasks, their advantages and uses were explained by the student guides.

After viewing molding and pouring operations, visitors were led to the core room. Here the various types of core boxes, sands and sand mixtures, and core making methods were demonstrated and explained. A core blowing machine attracted wide interest and was a source of amazement to many of the people attending the open house. An explanation and demonstration of the operation of the sand mixer and core oven were included in the core department's part in the show.

Typical sand tests and sand testing equipment were shown in the sand testing laboratory. Visitors watched students test sands

FOUNDRY EXHIBIT STEALS SHOW
At University Of Illinois Open House

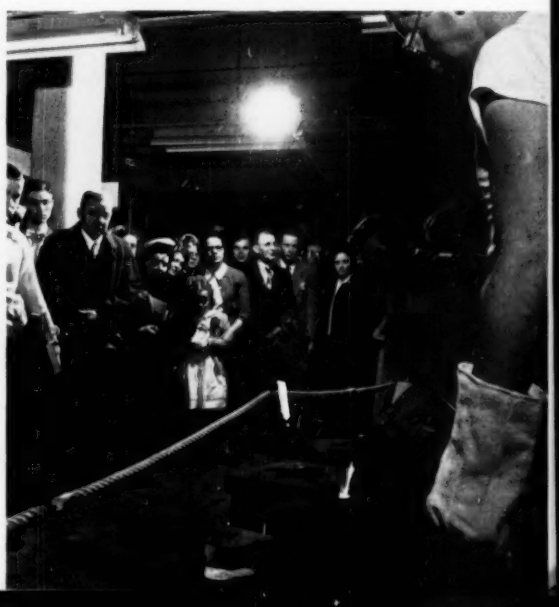
Stanley A. Appelt, Student
Mechanical Engineering Department
University of Illinois—Navy Pier

OVERFLOW CROWDS filled the Metals Casting Laboratory again this year during the second annual open house of the University of Illinois Chicago Undergraduate Division at Navy Pier April 19 and 20. Main attraction was the pouring operation which intrigued the several thousand visitors who attended.

Visitors—including many members of the Chicago Chapter of A.F.S.—were greeted by R. E. Kennedy, secretary emeritus of the Society, now in charge of the Navy Pier foundry laboratory (shown above tilting electric furnace). Assisting in the supervision of the crew of foundry students who acted as foundrymen and guides were: Roy W. Schroeder, chairman of the A.F.S. Apprentice Contest Committee and head of the pattern design course; Glenn E. Cramer of the engineering drawing department who taught in the Metals Casting Laboratory last year; and Wayne A. Wright, mechanical assistant in the laboratory.

Open house attendants watched students melt and pour cast iron and aluminum using molds and cores prepared between heats. Souvenir ash trays shaped like a small frying pan were picked up so fast by the visitors that many were taken away before the crew had a chance to clean and finish them. Because of the intense interest in the foundry operations special precautions were taken to protect visitors as well as student workers. Visitors watched pouring operations from roped-off lanes while pouring crew and weight shifters wore safety goggles, leggings, and asbestos gloves. Iron was for permeability, refractoriness, and moisture and learned how these and other tests are used by foundrymen to produce better castings.

Commenting on the open house, Professor Kennedy said that exhibits and demonstrations of the type put on at the University of Illinois Chicago Undergraduate Division along with those put on at other schools illustrate the fascination the relatively unknown foundry industry has for the public. Students and faculty like to feel they are educating the public to the importance of castings and methods of making them, he declared.



WHO'S WHO

A. L. DeSy

Dr. Albert L. De Sy, whose "*Further Results of Belgian Nodular Cast Iron Research*," Page 75, is his second report to readers of this magazine on his work and that of his Belgian colleagues in nodular iron developments, is professor of Metallurgy at the University of Ghent, Belgium, has long been active in developing new methods of producing nodular iron . . . He is author of many treatises and texts on the metallurgy of gray iron, steel and stainless steel. Head of the University of Ghent's Metallurgy Department, Dr. De Sy, a graduate of that institution, has also held executive positions in Belgian and Czech industry.

J. W. Anibal

John W. Anibal, author of "*Mechanized Sand Conditioning and Distribution System at Ohio State*," Page 85, is a senior industrial engineering student at Ohio State University, where, as a student assistant in the Foundry Laboratory, he has been co-designer of the sand conditioning and distribution system described in this article . . . A veteran of three years' service with the Army Engineers during World War II, Mr. Anibal will graduate next month as an Industrial Engineer.

Milton Tilley

Milton Tilley, author of "*Malleable Iron Annealability*," Page 88, is Cleveland Works metallurgist for the National Malleable & Steel Castings Co., where he has been employed since his graduation from Rose Polytechnic Institute with a bachelor of science degree . . . A native of Indiana, Mr. Tilley served as an aviation instructor in World War I, with the rank of Lieutenant . . . He has been a member of A.F.S. since 1928, and has spoken before the Society on malleable iron metallurgy . . . He is a member of the A.F.S. Malleable Research Committee.

L. L. Whitney

L. L. Whitney, author of "*Metallurgical Oxygen Speeds Foundry Open Hearth Melting*," Page 57, has been with American Steel Foundries since 1941, first as a staff member of the Research Laboratory at Granite City, Ill., then with the company's Cast Armor Plant at Indiana Harbor, Ind., and since 1945 as melted metals superintendent at the Alliance Works of ASF . . . He is a graduate of Purdue University (1939) with a bachelor of science degree in chemical engineering.

C. A. Robeck

Clausen A. Robeck, author of "*Non-Ferrous Foundry Practice*," Page 64, is vice-president and superintendent of Gibson & Kirk Co., Baltimore, Md. . . . Holder of a B.S. in Electrical Engineering from Johns Hopkins University, Baltimore, Mr. Robeck has been with Gibson and Kirk since 1936, and a member of A.F.S. since 1942 . . . Secretary-Treasurer of the A.F.S. Chesapeake Chapter, he has been active in technical affairs of the A.F.S. Brass & Bronze Division and is a member of its Research and Recommended Practices for Non-Ferrous Alloys Committees.

H. W. Smith

Howard W. Smith, author of "*High School Benefits from Chapter-Teacher Cooperation*," Page 90, is supervisor of Foundry, Forge and Welding for the Chicago Public Schools . . . Holder of a B.S. in Engineering from the University of Illinois, Mr. Smith did graduate work at DePaul University, Chicago. Mr. Smith was appointed to his present position with the Chicago Public Schools in 1942, and has worked closely with the A.F.S. Chicago Chapter in the improvement of foundry education in that city's schools . . . Prior to that, Mr. Smith was supervisor of National Defense Training of Ship Welders and Aircraft Riveters for Pullman Standard Car & Mfg. Co. He is a member of the Textbook Committee of the American Foundrymen's Society.

Steel Department supervisors of Gunite Foundries Corp., Rockford, Ill., display an award presented by American Mutual Insurance Co. for operating 250,000 consecutive hours without a lost-time accident. Left to right: John Olivieri, Ted Broomfield, Charles Angers and Phil Graciana.

New AFS MEMBERS

NEW SUSTAINING MEMBERS

Superior Foundry, Inc., Cleveland—W. L. Seelbach, Pres. & Gen. Mgr. (Northeastern Ohio Chapter)—Conversion from Company.

NEW COMPANY MEMBERS

Armco Steel Corp., Ashland, Ky.—G. H. Todd, Asst. Gen. Supt. (Cincinnati Chapter).

W. S. Hodge Foundry, Greenville, Pa.—W. S. Hodge, Prop. (Northwestern Pennsylvania Chapter)—Conversion from Personal.

Malleable Fittings, Harbor City, Calif.—John P. Swaino, Plant Supt. (Southern California Chapter).

Sloan Valve Co., Chicago—James Swartz, Supt. (Chicago Chapter).

Specialloy, Inc., Chicago—Mitchell Silverstein, Vice Pres. (Chicago Chapter).

Kendallville Foundry, Inc., Kendallville, Ind.—Richard R. Cole, Pres. (Michiana Chapter).

BIRMINGHAM DISTRICT CHAPTER

Fred C. Barbour, Chief Met., McWane Cast Iron Pipe Co., Birmingham.
Charles R. Chaney, Time Study Appr., McWane Cast Iron Pipe Co., Birmingham.
Robert Wilson Clowdus, McWane Cast Iron Pipe Co., Birmingham.
Albert R. Doss, Time Study Man, McWane Cast Iron Pipe Co., Birmingham.
Aaron S. Glidewell, Student, University of Alabama, University, Ala.
Leonard G. Henry, Secy., Attalla Pipe & Foundry Co., Attalla, Ala.
Lester A. Hogan, Fdy. Fmn., American Cast Iron Pipe Co., Birmingham.
Frank Kopp, Melt. Supv., McWane Cast Iron Pipe Co., Birmingham.
C. J. Pruet, Time Study Supv., McWane Cast Iron Pipe Co., Birmingham.
Tom Reese, Jr., Res. Dept., J. B. Clow & Sons, Birmingham.
J. H. Reeves, Fdy. Supt., Stockham Valves & Fittings, Birmingham.
G. M. Sinyard, Gen. Fdy. Fmn., McWane Cast Iron Pipe Co., Birmingham.

CENTRAL ILLINOIS CHAPTER

Joseph L. Oberle, Met., Res. Dept. Caterpillar Tractor Co., Peoria, Ill.
Joseph A. Trimarco, Fmn., Caterpillar Tractor Co., Peoria, Ill.

CENTRAL INDIANA CHAPTER

Albert Bradley, C. & G. Foundry & Pattern Works, Inc., Indianapolis.
Jean Danenfelser, Asst. Gen. Fdy. Supt., International Harvester Co., Beech Grove, Ind.
Ralph W. Wechsler, Insp. Supt., Delco Remy Div., General Motors Corp., Anderson, Ind.
Joseph N. Clyne, Secy. & Sales Engr., Vonnegut Moulder Corp., Indianapolis.

CENTRAL MICHIGAN CHAPTER

Howard C. Bennett, Secy. & Gen. Mgr., Capital Casting Co., Lansing, Mich.
J. E. Grabbert, Time Study Engr., Gale Mfg. Co., Albion, Mich.
Rollo Hastings, Molding Fmn., Gale Mfg. Co., Albion, Mich.
Lewis Heisler, Met., Gale Mfg., Co., Albion, Mich.
Alfred L. Hollibaugh, Core & Plant Supt., Gale Mfg. Co., Albion, Mich.
Rex D. Humphrey, Fdy. Fmn., Gale Mfg. Co., Albion, Mich.
Carlton Lamphier, Asst. Core Supt., Gale Mfg. Co., Albion, Mich.
Julius Rutz, Molding Supt., Gale Mfg. Co., Albion, Mich.
Arthur Thunold, Fdy. Supt., Gale Mfg. Co., Albion, Mich.

CENTRAL OHIO CHAPTER

Edgar N. Sampson, Engr., Dayton Malleable Iron Co., Ironton, Ohio.
Lloyd L. Seestedt, Fdy. Engr., Jeffrey Mfg. Co., Columbus, Ohio.

CHESAPEAKE CHAPTER

Roy M. Goins, Molder, Naval Research Laboratory, Washington, D. C.
Joy McReynolds, Electric Melter, Naval Research Laboratory, Washington, D. C.
Roy Seigh, Molder, Naval Research Laboratory, Washington, D. C.
Fred E. Uhl, Dist. Sales Engr., American Wheelabrator & Equipment Corp., Baltimore.

CHICAGO CHAPTER

Gordon E. Brown, Sales Engr., Imperial Belting Co., Chicago.
John T. Davis, Core Room Fmn., Pettibone Mulliken Corp., Chicago.
Brooks T. Hogan, Chief Met., Alum. Plant, Howard Foundry Co., Chicago.
Karl E. Mangels, Melting Fmn., Chicago Foundry Co., Cicero, Ill.
James T. Moore, Office Mgr., Wells Mfg. Co., Skokie, Ill.
Specialloy, Inc., Chicago—(Mitchell Silverstein, Vice Pres.).
Sloan Valve Co., Chicago—(James Swartz, Supt.).
Raymond Tregler, Ptn. Shop Leader, Danly Machine Specialties, Inc., Chicago.
J. H. Wright, Pres., Rite-Way Castings Co., Chicago.
John T. Zayner, Fdy. Met., International Harvester Co., Chicago.

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Clarence J. Albers, Cupola Fmn., Buckeye Foundry Co., Cincinnati.
C. W. Briel, Jr., Asst. Prod. Mgr., Ingot Div., Reynolds Metals Co., Louisville, Ky.
John M. Farnbacher, Indus. Engr., G. H. R. Fdy. Div., D. M. I. Co., Dayton, Ohio.
Harry Harmeyer, Plant Supt., Buckeye Foundry Co., Cincinnati.
Carl M. Lyons, Supt., Grey Iron Fdy., Armco Steel Corp., Ashland, Ky.
Donald L. Maujer, Chief Engr., Buckeye Foundry Co., Cincinnati.
John J. Metz, Pattern Fmn., Buckeye Foundry Co., Cincinnati.
Helen L. Redmond, Met., Buckeye Foundry Co., Cincinnati.
Garnet Riley, Jr., Molding Fmn., Buckeye Foundry Co., Cincinnati.
William Sutphin, Molding Foundry Co., Cincinnati.
Armco Steel Corp., Ashland, Ky.—(G. H. Todd, Asst. Gen. Supt).

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Dallas C. Amburn, Fdy. Engr., Ford Motor Co., Dearborn, Mich.
Hugh A. Barsanti, Factory Repr., Master Pneumatic Tool Co., Detroit.
Louis James Pedicini, Project Engr., General Motors Process Dev. Sec., Detroit.
John G. Walker, Asst. Chief Insp., Michigan Steel Casting Co., Detroit.

EASTERN CANADA CHAPTER

Leonard Bradley, Estimating & New Methods, Canadian Ingersoll-Rand Co., Sherbrooke, Que., Canada.
Norman E. Bradley, Fmn., Pattern Shop, Canadian Ingersoll-Rand Co., Sherbrooke, Que., Canada.
Herve Charest, Sand Tester, Superheater Co., Ltd., Sherbrooke, Que., Canada.
Earl H. Chilvers, Fmn., Core Room, Canadian Ingersoll-Rand Co., Sherbrooke, Que., Canada.
Dudley Coates, Fdy. Mgr., Canadian Ingersoll-Rand Co., Sherbrooke, Que., Canada.
J. Romeo Collins, Floor & Machine Molder, Canadian Ingersoll-Rand Co., Sherbrooke, Que., Canada.
Justin O. Custeau, Fdy. Dept., Price Bros. Co., Kenogami, Que., Canada.
Robert J. Feltrin, Dominion Engineering Works, Ltd., Montreal, Que., Canada.
T. Gordon, Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
Alfred James, Asst. to Prod. Supt., Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
Frank E. Sutherland, Dominion Engineering Works, Ltd., Lachine, Que., Canada.
Jacques Tessier, Molder, Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
Jacques Thome, Steel Grit of Canada, Ltd., L'Assomption, Que., Canada.
William S. Williams, Fmn., Canadian Car & Foundry Co., Longue Pointe, Que., Canada.

EASTERN NEW YORK CHAPTER

Francis A. Dugan, Wage Rate & Planning, General Electric Co., Schenectady, N. Y.
Harvey Haessly, Coremaker, Carboloy Co., Fort Edward, N. Y.
Harry W. Weart, Student, Rensselaer Polytechnic Institute, Troy, N. Y.

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W. J. Olson, Chief Constr. & Maint. Dept., American Brake Shoe Co., Mahwah, N. J.
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Harry R. Howell, Prod., Kendallville Foundry Inc., Kendallville, Ind.
Virgil A. Miller, Pres., Acme Pattern Works, Inc., Elkhart, Ind.
J. V. Shafer, Owner & Operator, Peerless Pattern Works, South Bend, Ind.
Wade H. Stine, Owner & Gen. Mgr., Watervliet Foundry Co., Watervliet, Mich.

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H. F. Ballinger, Sales, Fanner Manufacturing Co., Cleveland.
H. Malcolm Baldrige, Jr., Edv. Supt., Eberhard Mfg. Co., Div. Eastern Malleable Iron Co., Cleveland.
Harold J. Brown, Edv. Met., Sandusky Foundry & Machine Co., Sandusky, Ohio.
John S. Hawley, Sales Mgr., Fanner Manufacturing Co., Cleveland.
Willard R. Hohl, Met., W. O. Larson Foundry Co., Grafton, Ohio.
John Peck, Jr., Fmn., National Mall. & Steel Castings Co., Cleveland.
Dan D. Profant, Student, Case Institute of Technology, Cleveland.
J. G. Steinebach, Jr., Ind. Engr., Aluminum Co. of America, Cleveland.

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Edward J. Rock, Edv. Met., Fairbanks, Morse & Co., Beloit, Wis.

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John E. Fries, Jr., American Brake Shoe Co., Meadville, Pa.
George J. Heintz, J. A. Zurn Manufacturing Co., Erie, Pa.

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Robert E. McCarthy, International Harvester Co. of Canada, Hamilton, Ont., Canada.
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T. O. Stout, Salesman, National Adhesives Can Ltd., Toronto, Ont., Canada.
Ronald W. Morris, Engr. Supt., Anthes Imperial Co., St. James, Man., Canada.

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Clarence K. Johnson, Insp., Electric Steel Foundry, Portland, Ore.
Marvin B. Woolfolk, Salesman, Pacific Grinding Wheel Co., Portland, Ore.

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Charles H. Preston, Engr., Pepee Machine Co., Shortsville, N. Y.

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Joseph A. Sutorik, Student, General Motors Institute, Flint, Mich.
Thomas R. Wiltse, Appr., Saginaw Malleable Iron Plant, G.M.C., Saginaw, Mich.

SOUTHERN CALIFORNIA CHAPTER

Paul W. Koenig, Owner, Mastercraft Pattern Service, Huntington Park, Calif.
John Smith, Compton Foundry, Compton, Calif.
Malleable Fittings, Harbor City, Calif.—(John P. Swaino, Plant Supt.).

ST. LOUIS CHAPTER

John Ashlolt, Appr., American Steel Foundries, Granite City, Ill.
James L. Bailey, Appr., K-R-S Bronze Foundry, St. Louis.
Richard Bowman, Appr., American Car & Foundry Co., St. Louis.
William Burkholder, Appr., Central Pattern Co., St. Louis.
Paul De Santis, Appr., K-R-S Bronze Foundry, St. Louis.
Russell Elze, Appr., Central Pattern Co., St. Louis.
Martin E. Gorman, Asst. Sales Mgr., Texas Foundries Inc., St. Louis.
Merle R. Griener, Appr., Remmers Pattern Co., St. Louis.
Warren Hey, Appr., Quality Pattern Co., St. Louis.
Eugene Kaetzel, Appr., Central Pattern Co., St. Louis.
Ernest Kramer, Appr., Quality Pattern Co., St. Louis.
Denny Leisner, Dist. Sales Mgr., Laclede-Christy Co., St. Louis.
William McGrew, Appr., Semi-Steel Casting Co., St. Louis.
John K. Nimock, Salesman, Laclede-Christy Co., St. Louis.
James A. Rice, Met., Semi-Steel Casting Co., St. Louis.
Allen Schroder, Appr., National Bearing Metals, St. Louis.
Carson Seawel, Appr., Progressive Pattern Co., St. Louis.
William K. Y. Tao, Instr., Mech. Engrg. Dept., Washington University, St. Louis.
Carl Van Alstine, Appr., K-R-S Bronze Foundry, St. Louis.
H. G. McWalter, Service Engr., Laclede-Christy Co., St. Louis.
Eugene J. Ziaja, Pattern Maker, Carondelet Foundry, St. Louis.
William M. Zimmer, Appr., Arnette Pattern Co., Granite City, Ill.

TENNESSEE CHAPTER

O. W. Dodd, Ass't Edv. Fmn., Athens Stove Works, Athens, Tenn.
Lee A. Kleeman, Sales Engr., Harbison-Walker Refractories Co., Birmingham.
F. O. Mabery, Jr., Secy.-Treas., Athens Stove Works, Athens, Tenn.
G. F. Taylor, Edv. Fmn., Athens Stove Works, Athens, Tenn.

TEXAS CHAPTER

Henning B. Dieter, Cons. Engr., Austin, Texas.
William C. George, Sales Engr., American Brake Shoe Co., Electro Alloys Div., Houston, Texas.
Thomas J. Gaffney, Asst. Purch. Agent, Texas Electric Steel Casting Co., Houston, Texas.
W. F. Smith, Pattern Shop Supv., Texas Steel Co., Ft. Worth, Texas.

TOLEDO CHAPTER

Wayne W. Camp, Salesman, Freema. Supply Co., Toledo, Ohio.
R. W. Furman, Sales Repr., E. F. Houghton & Co., Toledo, Ohio.
Charles Frederick Wachter, The Freeman Supply Co., Toledo, Ohio.

TRI-STATE CHAPTER

Richard F. Gieselman, Rsch. Spec. Institute of Science & Tech., University of Arkansas, Fayetteville, Ark.

TWIN CITY CHAPTER

Ray R. Fisher, Supt., Albert Lea Foundry Co., Albert Lea, Minn.
Albert C. Holler, Asst. Analytical Chemist, Twin City Testing & Engineering Laboratory, St. Paul, Minn.
G. H. Lathrop, Salesman, Koppers Co., St. Paul, Minn.
H. R. Wesenberg, Sales Mgr., Koppers Co., St. Paul, Minn.

WASHINGTON CHAPTER

Vernon W. Rowe, Mgr., Ballard Pattern & Brass Foundry, Seattle.

WESTERN MICHIGAN CHAPTER

George W. Cannon, Jr., The Nugent Sand Co., Muskegon, Mich.
Joseph M. Ferrell, Jr., Met., West Michigan Steel Foundry Co., Muskegon, Mich.
George A. Gokey, Lab. Tech., West Michigan Steel Foundry Co., Muskegon, Mich.
Edwin Olsen, Edv. Supt., Dake Engine Co., Grand Haven, Mich.
Charles M. Pierce, Fmn., West Michigan Steel Foundry Co., Muskegon, Mich.

WESTERN NEW YORK CHAPTER

Joseph P. Ekey, Coremaker, Worthington Pump & Mach. Corp., Buffalo, N. Y.

WISCONSIN CHAPTER

John D. Losse, Student, University of Wisconsin, Milwaukee.
Frank Brendler, Sales Engr., Grede Foundries, Inc., Milwaukee.
Martin Chambers, Met., Nash Motor Div., Nash-Kelvinator Corp., Kenosha, Wis.
Alban A. Flechsig, Edv. Engr., Grede Foundries Inc., Milwaukee.

STUDENT CHAPTERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Jess L. Belser
William J. Callahan
Howard D. Chapman
John Whitford Conley
Herbert A. Frankel
John P. Lynch, Jr.
R. Waldemar Niemela

OHIO STATE UNIVERSITY

Allen L. Smith
Rolland K. Lenhart

MICHIGAN STATE COLLEGE

Warren J. Eding
Mike Matus
William J. Sullivan
Xelle J. Wyble

OUTSIDE OF CHAPTER

Frank B. Mahoney, Richmond Radiator Co., Uniontown, Pa.
D. E. Mason, Owner, Mason Metal Products Co., Bradenton, Florida.
Clarence R. Lessig, Jr., Pres., H. & H. Foundry Machine Co., Jeannette, Pa.

INTERNATIONAL

Belgium

Jacques Foulon, Association Technique, de Fonderie de Belgique, Liege, Belgium.
Alexandre Ketin, Ingenieur Civil Metallurgiste A. I. Lg., J. Marichal Ketin & Cie, Liege, Belgium.

Czechoslovakia

Vladimer Zednik, Met. Engr., State College of Mining & Met., Czechoslovakia.

England

Moti Thadhani, Student, National Foundry College, Wolverhampton, England.

India

Shantilaj J. Jain, Student Trainee, Gov. of Madhyabharat India, Madhyabhara, India.

Italy

Zanier Danilo, Fonderie Friulane–V. Zanier & Figlio, Udine, Italy.

Japan

Hiroshi Kohira, Yawata Iron & Steel Works, Kokuracity, Japan.
Sukeo Oda, Asst. Mgr., Fuso Steel Tube Works, Amagasaki City, Japan.
Shintaro Tabata, Agency of Industrial Science & Technology, Tokyo, Japan.
Kenkichi Toshima, Kobe Steel Works, Kobe, Japan.
Yoshihisha Ueyama, Asst. Mgr., Kawasaki Heavy Ind., Kobe City, Japan.

Repeat Defective Castings Meeting

Donald E. Webster
Rochester Chapter Reporter
American Laundry Machinery Co.

IDENTIFICATION AND CURE of castings defects was the theme of the April 11 meeting of the Rochester Chapter. Repeating the popular program of a year ago, the meeting started off with a contest among the more than 70 present to properly identify defects and suggest corrective measures for 10 castings used in the competition. The remainder of the castings selected by the committee were used as a basis for discussion later in the meeting.

Prize winners in the contest were: 1st—John W. MacMillan, Ingersoll-Rand Co., Painted Post, N. Y.; 2nd—H. V. Holst, Engineered Castings Div., American Brake Shoe Co., Rochester; and 3rd—R. J. Putnam, Ritter Co., Rochester. In last year's contest MacMillan placed second and Putnam was third prize winner.

Judging of the work of the contestants went on while they watched two motion pictures provided by Fanner Manufacturing Co., Cleveland, on chaplets and chills. Following announcement of the winners all the castings were thoroughly discussed as to the nature, cause, and cure of the defects. The extensive audience participation brought out a wide variety of practical foundry information.

Chapter President Herman G. Hetzler, Hetzler Foundries, Inc., Rochester, who presided at the meeting, headed the committee that collected the defective castings and staged the contest. Others were: Leon C. Kimpal, Rochester Gas & Electric Corp.; Kenneth R. Proud, Anstice Co.; Max T. Ganzauge, General Railway Signal Co.; H. G. Stellwegen, Hetzler Foundries; Duncan M. Wilson, Engineered Castings Div., American Brake Shoe Co.; Charles E. Vaughn, Ritter Co., Inc.; Walter G. Brayer, Bausch & Lomb Optical Co.; and L. C. Gleason, Gleason Works.

Left—Rochester foundrymen study defective castings in contest. Below—Some of the current and past officers and directors of the Rochester Chapter. Seated, left to right, are: Past President L. C. Gleason, Gleason Works; Director Charles E. Vaughn, Ritter Co., Inc.; Chapter President Herman G. Hetzler, Hetzler Foundries, Inc.; Vice-President Kenneth R. Proud, Anstice Co.; Director J. F. Steeves, Corbett-Steeves Pattern Works; and Director Edward J. Baker, Federated Metals Div., American Smelting & Refining Co., chapter membership chairman; Standing, left to right, are: Past President Max T. Ganzauge, General Railway Signal Co.; H. B. Hanley, American Laundry Machinery Co., first president of the Rochester Chapter; and Director Donald E. Webster, American Laundry Machinery Co., publicity chairman and chapter reporter. Photographs are by Charles Hooper, Ritter Co., Inc.

Chapter Officers F A S and Directors

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Rupp Pattern Co.
Rockford, Ill.
Director
No. Illinois-So. Wisconsin Chapter

Alex Pirrie
Gurney Foundry Co. Ltd.
Toronto, Ont.
Director
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Robert E. Woods
M. W. Warren Coke Co.
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American Hoist & Derrick Co.
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Badger Brass & Alum. Fdry. Co.
Milwaukee
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Wisconsin Chapter

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Standard Sanitary Corp.
Director
Chesapeake Chapter

H. L. Mead
John Deere Harvester Works
East Moline, Ill.
Director
Quad City Chapter

N. J. Henke
Saginaw Malleable Iron Plant
Saginaw, Mich.
Director
Saginaw Valley Chapter

FOUNDRY Personalities

J. S. Robbins, formerly on the staff of the melting department of Republic Steel Corp.'s Canton, Ohio, plant, has been named sales engineer for the Vulcan Mold & Iron Co., Latrobe, Pa.

Steel Founders' Society of America recently presented its top award for achievement, the Lorenz Memorial Gold Medal, to **A. J. McDonald,** vice-president of American Steel Foundries, Chicago, at the Society's Annual Meeting, held at the Edgewater Beach Hotel, Chicago. **John F. Lacey,** works manager for the Commercial Steel Castings Co., Marion, Ohio, received the Society's Technical and Operating Medal; and **S. F. Carter,** assistant melting superintendent, American Cast Iron Pipe Co., Birmingham, Ala., the Foundry Facts award for excellence of material published in the Society's annual periodical.

A. J. McDonald

Howard M. Brownrigg, who last year resigned as secretary of the A.F.S. British Columbia Chapter upon leaving the British Columbia Research Council, Vancouver, to become assistant metallurgist for the Dominion Engineering Works, Lachine, Que., has been named assistant works manager for the Joliette Steel Division of Dominion Brake Shoe Co., Ltd., Joliette, Que.

George H. Davis has joined the Iron and Non-Ferrous Casting Section of the Development and Research Division of the International Nickel Co., Inc., New York. A graduate of the Missouri School of Mines in 1917, Mr. Davis was with the Ohio Steel Foundry Co., Lima, Ohio, as iron foundry melter prior to joining Inco. He will be concerned primarily with developments of Ni-Hard alloy.

Robert S. Cave, formerly assistant sales manager, has been named general sales manager for Severance Tool Industries, Inc., Saginaw, Mich.

Paul A. Dunakin, formerly vice-president and general manager of *Popular Mechanics* magazine, Chicago, has been elected executive vice-president of the Hydro-Blast Corp., Chicago. Simultaneously, it was announced that **Ronald Webster** has been named sales manager of the company. Mr. Webster was vice-president and general manager of the company until 1941, when ill health forced him to serve the company in the capacity of consultant.

P. A. Dunakin

Harold A. Hill has been named Pittsburgh district manager for Lehigh Foundries, Inc., Easton, Pa. Mr. Hill, who has for the last 17 years been sales manager and general manager of the Fort Pitt Malleable Iron Co., has also been associated with the American Bridge Co., Ambridge, Pa., and Standard Steel Car Co., Butler, Pa.

William E. Clark has been named general manager of the Engineering Works Division of Dravo Corp., Pittsburgh. Mr. Clark has been a member of the Dravo Board of Directors since 1946 and a vice-president since 1947. He is also chairman of the company's sales committee.

Dr. James T. Eaton has been appointed director of research for E. F. Houghton & Co., Philadelphia oil and chemical manufacturers. Dr. Eaton, who was formerly titled manager of research, is in full charge of the company's Research and Control Dept. and was recently elected a member of the Board of Directors.

Arlo Israelson, formerly of Flynn Machine Co., Inc., San Jose, Calif., has been appointed chief engineer of the Erie2 Mfg. Co., Erie, Pa., succeeding **W. W. Mojden,** who is now with Mills-Winfield Co., Erie2 sales office in Chicago.

Dr. Carl E. Swartz, division engineer of the Kellex Corp., New York, has been named chairman of the Metals Research Department at Armour Research Foundation of the Illinois Institute of Technology. Dr. Swartz, who has been in charge of materials research and development at the Kellex applied physics laboratory in Silver Spring, Md., was previously chief metallurgist for the Cleveland Graphite Bronze Co. and prior to that was research metallurgist for the American Smelting & Refining Co. Dr. Swartz is holder of 15 patents in the field of metallurgy.

C. E. Swartz

Dr. Francis C. Frary, director of research, Aluminum Research Laboratories, Aluminum Co. of America, was recently awarded the James Douglas Metallurgical Medal for 1950 by the American Institute of Mining and Metallurgical Engineers "for distinguished achievement in science and contributions to society by broadening the field of knowledge in all phases of the aluminum industry and for notable success in directing a vast research project in this industry."

W. G. Schuller, assistant purchasing agent, Caterpillar Tractor Co., Peoria, Ill., has been named purchasing agent for the company's Joliet, Ill., operations, and Otto F. Wiesemann, scheduling division manager in the Manufacturing Department, has been appointed production division manager at Joliet. Mr. Schuller, who is

vice-chairman of the A.F.S. Central Illinois Chapter, headed purchasing for Caterpillar's Casting division in his former position and will be succeeded by **W. J. Bornholdt,** who will have charge of the Steel, Forging and Casting Division of the Purchasing Department.

On the occasion of their completion of 50 years' service to the foundry industry, several officials of the Birdsboro Steel Foundry & Machine Co. were honored at

Marshall Post

a dinner at the Hotel Warwick, Philadelphia. Honored were A.F.S. Past National President **Marshall Post** of Birdsboro; **E. M. Schumo,** Pennsylvania Electric Steel Co.; and **H. K. Pollard,** Treadwell Engineering Co. **G. Clymer Brooke** of Birdsboro Steel Foundry & Machine Co., who recently completed two years as a director of the Steel Founders' Society, was also an honored guest.

E. T. Peterson

E. T. Peterson, who has been associated with the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., for 27 years and recently as chief engineer in the Rolling Mill Dept., has been named vice-president in charge of engineering.

Claude E. Monlux, vice-president of the Linde Air Products Co., New York, was elected president of the International Acetylene Association during that organization's annual convention March 27.

(Continued on Page 128)

A. F. S. CHAPTER DIRECTORY

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NORTHWESTERN PENNSYLVANIA CHAPTER *Secretary,* Earl Strick, Erie Malleable Iron Co., Erie, Pa.

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OREGON CHAPTER *Secretary-Treasurer,* Harry K. McAllister, 627 S. E. 71st Ave., Portland, Ore.

PHILADELPHIA CHAPTER *Secretary-Treasurer,* W. B. Coleman, W. B. Coleman & Co., 9th and Rising Sun Ave., Philadelphia

QUAD CITY CHAPTER *Secretary-Treasurer,* C. R. Marthens, Marthens Co., 3094½ 16th St., Moline, Ill.

ROCHESTER CHAPTER *Secretary-Treasurer,* Leon C. Kimpal, Rochester Gas & Electric Corp., 89 East Ave., Rochester 4, N. Y.

SAGINAW VALLEY CHAPTER *Secretary-Treasurer,* Raymond H. Klawuhn, General Foundry & Mfg. Co., P. O. Box 119, Flint, Mich.

ST. LOUIS DISTRICT CHAPTER *Secretary,* P. E. Retzlaff, Busch-Sulzer Bros.-Diesel Engine Co., Div., Nordberg Mfg. Co., 5300 S. Second St., St. Louis

SOUTHERN CALIFORNIA CHAPTER *Secretary,* Harold G. Pagenkopp, Angelus Pattern Works, 2084 Belgrave Ave., Huntington Pk., California

TENNESSEE CHAPTER *Secretary-Treasurer,* Herman Bohr, Jr., Robbins & Bohr, Chattanooga Bank, Chattanooga, Tenn.

TEXAS CHAPTER *Secretary,* P. B. Croom, 5210 Canal, Houston, Texas

TIMBERLINE CHAPTER *Secretary,* James Schmuck, Rotary Steel Castings Co., 1425—5th St., Denver, Colorado

TOLEDO CHAPTER *Secretary-Treasurer,* R. C. Van Hellen, Unitcast Corp., Box 8, Station E, Toledo, Ohio

TRI-STATE CHAPTER *Secretary,* D. A. Mitchell, Progressive Brass Co., 1702 East 6th, Tulsa, Okla.

TWIN-CITY CHAPTER *Secretary-Treasurer,* Lillian K. Polzin, Minneapolis Chamber of Commerce, 1750 Hennepin at Groveland Terrace, Minneapolis

WASHINGTON CHAPTER *Secretary,* F. R. Young, E. A. Wilcox Co., 517 Arctic Bldg., Seattle 4, Wash.

WESTERN MICHIGAN CHAPTER *Secretary,* Ross Shaffer, Lakey Foundry & Machine Co., First and Water Sts., Muskegon, Mich.

WESTERN NEW YORK CHAPTER *Secretary,* R. E. Walsh, Hickman, Williams & Co., 32 Eastwood Place, Buffalo, N. Y.

WISCONSIN CHAPTER *Secretary,* G. E. Tisdale, Zenith Foundry Co., 1501 So. 85rd St., West Allis, Wis.

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OHIO STATE UNIVERSITY *Secretary-Treasurer,* Charles J. Weiland

OREGON STATE COLLEGE *Secretary,* Leonard M. Preston

TEXAS A & M COLLEGE *Secretary,* R. L. Jones

UNIVERSITY OF ALABAMA

Judges in the Detroit Chapter's Pattern Contest, held in preparation for the A.F.S. National Judging, are shown here with some of the many entries submitted by eastern Michigan apprentices. Judges are, left to right: John Gould, Gould Pattern Co.; Hartley S. Ball, City Pattern Foundry & Machine Co.; M. D. McQuary, Chrysler Corp.; Vaughan C. Reid, City Pattern Foundry & Machine Co.; Paul Copeland, Ford Motor Co.; Willard Kidwell, Packard Motor Car Co.; and L. H. Kinney of the Chrysler Corporation.

CHAPTER ACTIVITIES NEWS

Winning apprentices in the Detroit Chapter's recent Pattern Contest, shown with their entries, were, left to right: Arthur S. Prouse, Beaver Pattern Co. (2nd prize, wood); Arthur Z. Nogas, Packard Motor Car Co. (3rd prize, wood); John Olds, City Pattern Foundry & Machine Co. (1st prize, wood); Wallace Shepler, Automotive Pattern Co. (3rd prize, metal); Joseph Collins, Packard Motor Car Co. (2nd prize, metal). Not shown is D. H. Stone, City Pattern Fdy. & Machine Co. (1st prize, metal).

Central Illinois

John R. Nieman
Caterpillar Tractor Co.
Chapter Reporter

JOINT MEETING with the Central Illinois Chapter of the American Society for Metals, held April 3, featured a talk on "*Nodular Iron*" by Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Lynchburg Foundry Co. has been experimentally making nodular iron for the past 16 months. Mr. Kuniansky presented many interesting observations. His background on this subject includes a recent visit with Europeans developing nodular iron techniques in France and England.

He discussed the early development of nodular iron using cerium instead of magnesium. "Cerium must be used with little or no phosphorus and is more expensive than magnesium," Mr. Kuniansky said.

Some of the properties this material has are—high wear resistance, high physical and heat shock resistance, high corrosion resistance, and weldability.

Experience to date indicates that present techniques make annealing

necessary when casting sections are under ¾". He said further that one of the greatest problems is in producing castings free from defects. The market for nodular iron will supplement malleable and invade steel castings, was Mr. Kuniansky's observation.

The question period revealed the following problems:

Optical pyrometers do not give true readings on nodular iron because of the skin of magnesium oxide. Pin hole defects make high pouring temperatures necessary. Migration of carbon from drag to cope is appreciable.

Further questions revealed that magnesium treatment does not wear off as do inoculants. One observation proved that the "treatment" was effective after 34 minutes.

"There is no good reason to believe that nodules actually form in the 'wet' in this material," Mr. Kuniansky concluded. Interest in this subject was evidenced by questions and discussion. A.F.S. National Director Frank Shipley, Caterpillar Tractor Co., chairman of the Nominating Committee, announced the following nominations for 1940-51 officers and directors:

Chairman, Clayton W. Russell, Caterpillar Tractor Co.; *vice-chairman*, Robert Dickison, Brass Foundry Co.; *secretary-treasurer*, Burton L. Bevis, Caterpillar Tractor Co.; and *directors*, L. G. Gunn and George Schuller, both of Caterpillar Tractor Co.

Convivial tablemates at Tennessee Chapter's March meeting, Chattanooga.

Speaker's table and some of the large crowd of foundrymen and their guests attending the April meeting of the Northeastern Ohio Chapter.

Detroit

Vaughn C. Reid
City Pattern Foundry & Machine Co.
Chapter Reporter

HIGHLIGHTS of the March 17 meeting were the awarding of certificates for the Chapter's Pattern Apprentices

More than 100 members of the Birmingham District Chapter met with the University of Alabama Engineering School faculty at a dinner climaxing all-day open house and inspection of the school's new Foundry Practices Laboratory, March 24. Prominent Alabama educators and foundrymen were banquet speakers.

Contest and a Casting Defect Clinic.

Certificates awarded for entries in the Pattern Apprentices Contest were: City Pattern Foundry & Machine Co., first place in both wood and metal divisions; Beaver Pattern & Foundry Co., second place, wood patterns; Packard Motor Car Co., second place in metal patternmaking and third place in wood patternmaking; and Automotive Pattern Co., third place, metal.

The meeting was then adjourned to reassemble in the auditorium where approximately 200 Detroit area foundrymen, headed by Michael Warchol, Atlas Foundry Company, Detroit, conducted the Casting Defect Clinic. Local foundrymen submitted samples of troublesome castings for discussion. There were several casting submitted. Mr. Warchol started a lively discussion on the type of defects and their possible causes.

N. Illinois—S. Wisconsin

Jerry M. Zilka
Gunite Foundries Corp.
Technical Secretary

OVER 100 MEMBERS and guests attended the regular dinner meeting March 14 at the Faust Hotel in Rockford, Ill., to hear Joseph Schumacher, Hill & Griffith Co., Cincinnati, speak on "*Sand Control in the Foundry.*"

Mr. Schumacher first related an experience with a core blowing problem. A company had the problem of eliminating the sticking of sand grains in the core boxes. The usual remedies, such as using dry sand, screens or slotted vents, kerosene spray and thorough cleaning after each day's run did not solve the problem.

Then the unorthodox was tried and a solution was found. It was wet core sand and a long mulling cycle. No special partings or additions were used to stop sticking and the boxes were cleaned with plain water. Yet sand sticking was eliminated.

The key, Mr. Schumacher said, was in the core sand mixture. It consisted of 240 qts of lake sand (Michigan City) up to 20 per cent bank sand containing 20 per cent clay, 3 per cent cereal binder (1 per cent by weight), $3\frac{1}{2}$ to 4 per cent water, and $2\frac{1}{4}$ qts core oil. These ingredients were mulled 12-15 minutes.

By experimentation this company found that the tendency of the core sand to stick decreased as mulling time increased and after 12-15 minutes of mulling it was eliminated. There was no measureable change in the physical properties of the sand because of the increase in mulling time, just a decrease in the tendency to stick.

Other practices followed by this company are: to wash cast iron core boxes in a water and oakite solution over night, wash brass and aluminum boxes in a soap solution, and use scratch vents where possible. By following this procedure the company has eliminated the sticking sand, cut baking time by 20 per cent, eliminated the use of core-driers and improved the surface finish of castings.

Mr. Schumacher went on to say that scrap can be reduced only through consistent control at all times. This would require a capable, dependable supervisor, the proper equipment and apparatus, established limits of all controllable properties for the particular foundry, and a complete scrap and sand property record.

By observing the behavior of scrap

Discussing core room costs at the March meeting of the Quad City Chapter were, left to right: Chapter Chairman E. P. Closen, John Deere Planter Works; Speaker L. P. Robinson, Werner G. Smith Co., Cleveland; and Harold Rasmussen, General Pattern Corp., vice-chairman of the Chapter.

FUTURE CHAPTER

● MAY 22
CENTRAL OHIO
Chittenden Hotel, Columbus
D. E. KRAUSE
Gray Iron Research Institute
"Metallurgy of Iron Carbon Alloys"
L. W. EASTWOOD
Battelle Memorial Institute
"Non-Ferrous Melting Practice"

NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
B. C. YEARLEY
National Malleable & Steel Castings Co.
"Casting Defects and Remedies"

● MAY 25
NORTHEASTERN OHIO
Tudor Arms Hotel, Cleveland
Old Timers' Night

● MAY 26
CHESAPEAKE
Engineers' Club, Baltimore
ROUND TABLE MEETINGS

● MAY 27
N. ILLINOIS-S. WISCONSIN
Beloit Country Club, Beloit, Wis
ANNUAL GOLF OUTING AND PICNIC

Speaker at the March meeting of the Wisconsin Chapter was Dr. Allen A. Stockdale of Milwaukee, on "Let's Build a Better America." (Photo courtesy Walter V. Napp, Badger Fire Brick & Supply Co.)

MEETING PROGRAMS

● ***MAY 27 (Cont'd)***

SOUTHERN CALIFORNIA
Lakewood Country Club
ANNUAL SPRING DANCE

● ***JUNE 3***

ST. LOUIS DISTRICT
Maple Grove
ANNUAL PICNIC

SAGINAW VALLEY
Potter's Lake and Brookwood Golf Club
ANNUAL SUMMER OUTING

● ***JUNE 5***

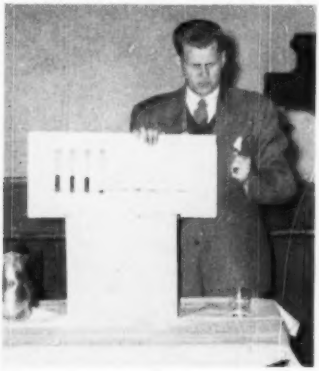
CHICAGO
Chicago Bar Association
ANNUAL BUSINESS MEETING

● ***JUNE 9***

SOUTHERN CALIFORNIA
Rodger Young Auditorium, Los Angeles
PAST PRESIDENT'S NIGHT

● ***JUNE 17***

QUAD CITY
Camp Nobel, Rock River, Moline, Ill.
ANNUAL OUTING



March meeting speaker Clyde A. Sanders, American Colloid Co., Chicago, used this chart to point up his talk on "Progress in Foundry Sand Practice" before members of the Central Michigan Chapter.

against the varying properties some clues might be found which would indicate the best sand properties for the particular castings being made.

Two sound movies were shown through the courtesy of Howard Slusser of Gunite Foundries Corp. The first movie followed the dinner and the second movie, an authentic naval invasion picture, was shown after the meeting was formally adjourned, by F. W. Thayer, also of Gunite Foundries Corp.

Texas

E. P. Clarke
American Wheelabrator & Equipment Corp.
Chapter Reporter

FEBRUARY 17 meeting featured a talk by W. E. George of Booz, Allen & Hamilton, Chicago, on *"Foundry Cost and Planned Profits."*

Augmenting his talk with use of graphs and charts, Mr. George made an interesting presentation of his subject. It was interesting to note the large number of management and accounting personnel present to hear Mr. George speak.

Chairman Charles McGrail, Texaloy Foundry Co., San Antonio, presided. Vice-Chairman W. H. Lane, III, Hughes Tool Co., Houston, introduced the speaker.

Twin City

J. D. Johnson
Werner G. Smith Co.
Chapter Reporter

Over 100 members and guests met April 11 at the Covered Wagon, Minneapolis, to elect 1950-51 officers and directors and to see the A.F.S. Research film, *"Fluid Flow in Transparent Molds."* As an added attraction, an exceptionally fine sound and color motion picture, *"Fishing in Alaska,"* was shown through the courtesy of the Nash Motor Co.

Officers and directors of the Chapter elected for 1950-51 are:

Chairman, S. L. Cameron, Jr., Valley Iron Works, St. Paul; *vice-chairman*, C. F. Quest, J. F. Quest Foundry Co., Minneapolis; *secretary-treasurer* (re-elected), Lillian K. Polzin, Manufacturers' Secretariat, Minneapolis Chamber of Commerce.

Directors (to serve three years): Arthur W. Johnson, Northern Malleable Iron Co.; Nathan Levinsohn, Minneapolis-Moline Co.; and O. J. Myers, Werner G. Smith Co. *Director* (one year), Charles F. Kausel, Kausel Foundry Co.

A vote of thanks was offered Retiring Chairman Franklin A. Austin, Crown Iron Works Co.

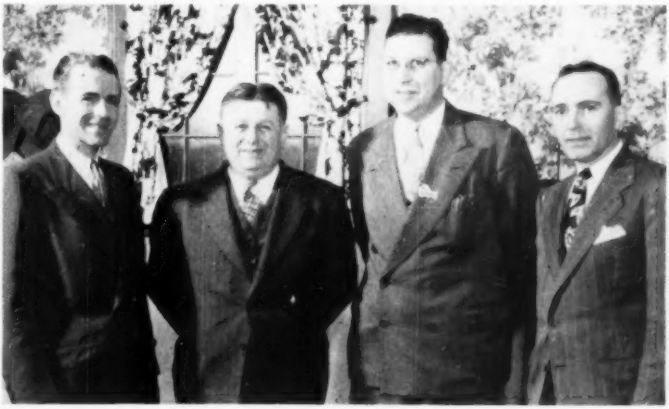
Washington

Harold R. Wolfert
Puget Sound Naval Shipyard
Chapter Reporter

MARCH MEETING held at the Gowman Hotel, Seattle, featured a talk by L. P. Robinson of the Werner G. Smith Co., Cleveland, on *"Cutting Core Room Costs"* and election of officers for 1950-51.

"It is time to get down to brass tacks," Mr. Robinson said, "and to improve our product, cut costs and save! save! save!" The foundry industry, Mr. Robinson continued, must be able to change with economic conditions and gear for the future to compete with other methods of metal fabrication.

To this end, Mr. Robinson offered



Photographed at the April 3 joint meeting of the A.F.S. Central Illinois and ASM Central Illinois Chapters were, left to right: ASM Chairman J. R. Sloan; Speaker Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.; A.F.S. Chairman C. W. Bucklar, Jr., Superior Foundry Co., and G. W. Russell, Caterpillar Tractor Co., A.F.S. technical chairman.

Dr. Jack T. Wilson (center), Allis-Chalmers Mfg. Co., Milwaukee, speaker at the April 4 meeting of the Western Michigan Chapter, explains a fine point in laboratory control methods to questioners following his talk. Left to right: L. D. Ramsey, Paul Weiner Foundry Co., chapter treasurer; Stanley H. Davis, Campbell, Wyant & Cannon Foundry Co., vice-chairman; Dr. Wilson; C. N. Jacobson, Dake Engine Co., chairman; and R. P. Schaffer, Lakey Foundry & Machine Co., secretary of the Chapter.

the following suggestions for cutting costs in the coreroom:

(1) Check core sand mixing routine—reasonably successful operation can be achieved in spite of poor methods but such methods must be corrected in order to lower costs.

(2) Check measures for accuracy—see that they are used and adhered to faithfully. Insure that the man at the mixer is reliable because much of the success of foundry operation depends upon his ability to turn out a uniform core sand.

(3) Test core mixtures against performance standards—find out how much oil is required and don't use more than is necessary just because a mixture decided upon a year ago calls for it. Excess binder is costly.

(4) Use information supplied by the sand technician to correlate mixtures to any change in base sand—changes in raw materials can be costly if first discovered in a lot of spoiled castings.

(5) Rule-of-thumb methods must be replaced by precise methods based on sound interpretation of sand data.

The speaker recommended the following mixing routine, which he said, according to tests has produced up to 40 per cent higher tensile strengths. Mix in the following order: sand, dry binder, oxide, bentonite, cereal, water and oil. Do not separate the water from the cereal.

Baking is an important coreroom operation, Mr. Robinson stated. In continuous baking operation, he recommended a one-shot baking time cycle. A second trip through, he said cannot do the core much good if it cools off at the end of the first cycle. Moisture content influences baked strength, as does grain size and shape, he added.

High moisture is used to obtain special properties but, the speaker said, it is well to remember that no baking takes place until moisture is driven off, and baking time must be adjusted accordingly. Mr. Robinson stressed the importance of using mixtures that make for ease of coremaking, and in closing said, "Exhaust every possibility to be certain that things are being done correctly in the coremaking room."

Newly-elected 1950-51 chapter officers and directors are:

President, Stanley Marshall, Atlas Foundry, Tacoma; *vice-president*, James Tracy, Salmon Bay Foundry, Seattle; *secretary*, Fred Young, E. A. Wilcox Co., Seattle; *treasurer*, Robert Tompkins, Western Foundry Sand Co., Seattle.

Directors: James Wessel, Puget Sound Naval Shipyard, Bremerton; J. Dolansky, Griffin Wheel Co., Tacoma; and William Mockey of Everett, Wash.

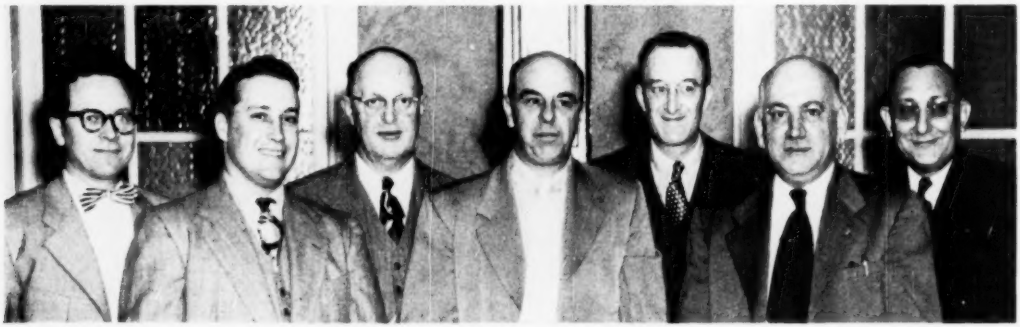
Central Michigan

F. P. Tobakos
Albion Malleable Iron Co.
Publicity Chairman

MARCH MEETING featured as guest speaker Clyde A. Sanders, American Colloid Co., Chicago, on *Progress in Foundry Sand Practice*."

Mr. Sanders started his talk by giv-

(Continued on Page 108)

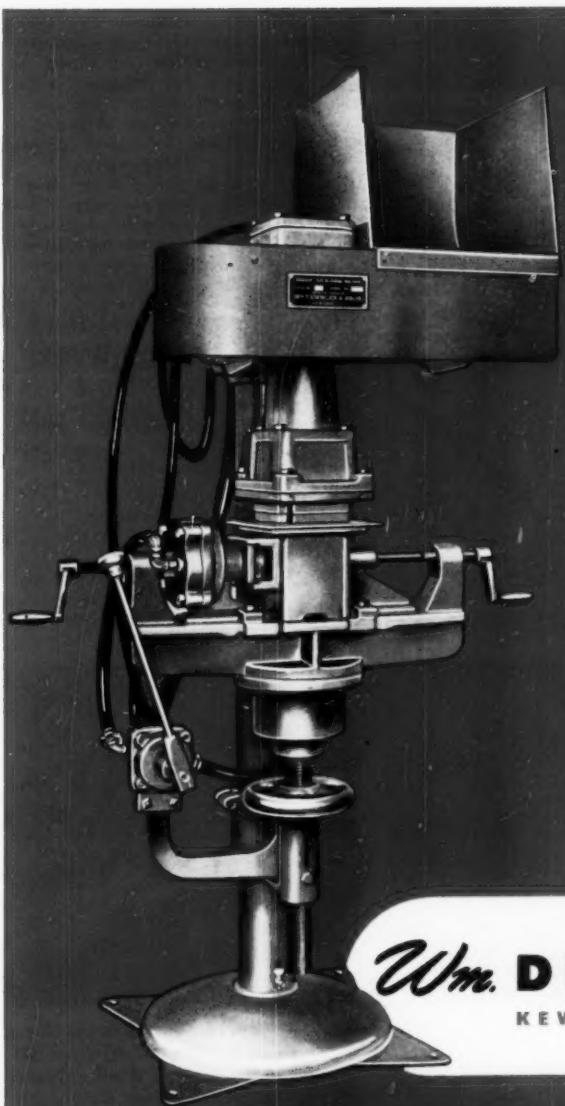


New officers and both incumbent and newly-elected directors of the Michiana Chapter, grouped at the chapter's April meeting, were, front row, left to right: H. D. Hunt, Auto Specialties Mfg. Co, incumbent director; V. C. Bruce, Frederic B. Stevens, Inc., secretary-treasurer; Leslie Pugh, Casting Service Corp., new director. Back row, left to right: E. S. Wegenke, Sibley Machine & Foundry Corp., incumbent director; William Ferrell, Auto Specialties Mfg. Co., chairman; Roy A. Payne, Sterling Brass Foundry, new director; and Vice-Chairman S. F. Krzeszewski of the American Wheelabrator & Equipment Co., Mishawaka, Indiana.

NO. 55

DEMMLER

CORE BLOWING MACHINE



IDEAL FOR FAST, ECONOMICAL PRODUCTION ON SHORT RUN JOBS

Short run jobs can be profitable, too!

The DEMMLER No. 55 is proving it every day . . . day after day in foundries everywhere. This small, rugged, efficient core blower is ideal for blowing cores weighing up to four pounds; was especially designed to fill the foundryman's need for just such work.

Sand magazine and carriage are aluminum castings, mounted on ball bearing rollers for utmost ease in pushing from filling to blowing position.

The DEMMLER No. 55 has both vertical and horizontal air operated core box clamps, controlled automatically by the same hand valve that blows the core.

This versatile machine will accommodate boxes 9 inches long, has sliding, quick change blow plates and features a trouble-free diaphragm type blow valve.

Sand magazine opening is 4½ by 9½ inches. Three different sand magazine sizes available.

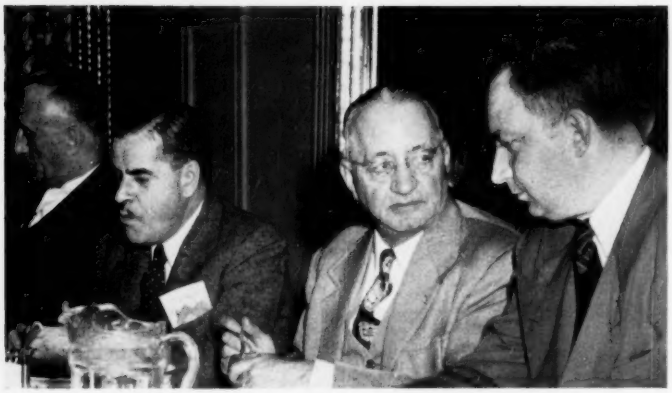
Simple in construction . . . simple in operation, the DEMMLER No. 55 core blower is the economical solution—the profitable solution—to the rapid production of high quality small cores. Very reasonable in cost, the DEMMLER No. 55 is an extremely worthwhile addition to any foundry, large or small.

Illustrated specification sheet will be sent on request.

Wm. **DEMMLER** *& Bros.*

KEWANEE, ILLINOIS

Manufacturers of Core Blowing Equipment Exclusively Since 1911



At the speakers' table at the March meeting of the Wisconsin Chapter were, left to right: H. J. Dempsey, Crucible Steel Casting Co.; C. M. Lewis, Badger Malleable & Mfg. Co.; L. R. Tanner, Zenith Foundry Co.; and Chapter Treasurer Leon Decker of Allis-Chalmers Mfg. Co. (Photo courtesy of Walter V. Napp, Badger Fire Brick & Supply Co., Milwaukee).

ing a brief history of the development and use of synthetic sands, stressing the high cost of any addition with respect to natural bonded sands. If foundrymen were to give naturally bonded sands the study and control that has been given to synthetic sands, there would not be as many synthetic sands, the speaker said.

With the aid of a few charts and graphs, Mr. Sanders proceeded to explain the results of some of the experiments he has conducted and a few of the theories he has arrived at. He has recently completed some special work on sands at Michigan State College in collaboration with Professor C. C. Sigerloos and others. Mr. Sanders is a firm believer that a good many casting defects attributed to iron are in many cases caused by poor or improper sand conditions.

Technical chairman for the evening was David Boyd, Engineering Castings, Inc., Marshall.

Western New York

Roger E. Walsh
Hickman, Williams & Co., Inc.
Chapter Secretary

MORE THAN 85 MEMBERS and guests attended the March 3 meeting, held at the Hotel Sheraton, Buffalo, to hear two speakers, Earl R. Pierce and Alexander H. Colwell of Exothermic Research Products, Inc., Buffalo.

Speaking on *"Plastic Patterns,"* Mr. Pierce stated that for a long time this method had been retarded because of difficulties in drying, curing, etc., but that he has developed a method of curing plastic at room temperature by means of a catalyst that causes the plastic to set in five minutes.

This material, he said, has been adapted to foundry use and causes no shrinkage. The setting-up speed, Mr. Pierce said, can be controlled by the amount of the catalyst used in the mix and hand patterns can be removed from the molds in five minutes.

Mr. Pierce showed photographs and samples of coreboxes made from plastic materials.

Speaking on exothermic materials, Mr. Colwell defined exothermic as any action giving off heat. In the foundry, he said, exothermic materials are used to delay or hold heat when placed on top of risers, thus maintaining temperatures and promoting directional solidification. Methods of using exothermic materials are determined by the size of risers, volume and wall area.

Chicago

Paul Skirha
Crane Co.
Chapter Reporter

LARGEST ATTENDANCE of the year, more than 250 members and guests, heard Charles K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala., speak on *"Nodular Iron."*

Mr. Donoho discussed the history of the development of nodular iron, explaining that the earliest work with alkali earth metals was done in this country in the early 1920's. This work, the speaker said, showed that graphite shape and distribution were altered through the addition of such metals as calcium. It was later shown that nodular iron was developed in Germany as early as 1938. The speaker then discussed the work of English researchers, and subsequent developments in the United States.

Mr. Donoho illustrated his talk with slides showing microstructures of nodular iron and graphs showing the proper magnesium contents for maximum physical properties. One interesting point brought out by the speaker was the work which has been done with pouring temperatures of nodular iron. Liquid nodular iron maintains an extremely high flowability at low pouring temperature.

A lively question and answer session following Mr. Donoho's talk indicated extreme interest on the part of the audience on the subject.

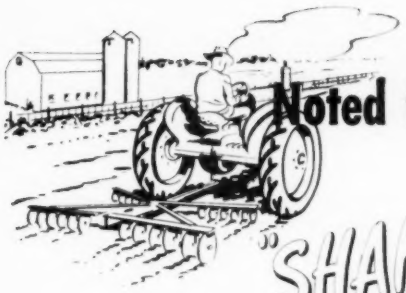
Quad City

R. E. Miller
John Deere Planter Works
Chapter Reporter

NODULAR IRON, a "magnetic" topic to foundrymen, proved its drawing

(Continued on Page 110)

An informal get-together following the February 17 meeting of the Texas Chapter included, left to right: Chapter Vice-Chairman W. H. Lyne, III, Hughes Tool Co.; Secretary P. B. Croom, Houston Pattern Works; Speaker W. E. George, Booz, Allen & Hamilton, Chicago; Chairman Charles McGrail, Texaloy Foundry Co.; and Secretary Edward Wey, Dee Brass Foundry. (Photograph courtesy of C. E. Silver of Texas Electric Steel Co., Houston).



Noted farm equipment manufacturer "SHAKES" DUST PROBLEM!

"SHAKE-OUTS" EQUIPPED WITH KIRK & BLUM DUST CONTROL SYSTEM . . .

Shake-outs have long been the dustiest, dirtiest section of a foundry. Not so in this modern plant. Kirk & Blum installed these efficient "over-and-under" hoods which collect dust as it is released in the shake-out operation. In the photo above, six of the shake-out stations are seen. Piping is designed to meet AFA standards; note the cleanout doors and gasketed companion angle connections.

This installation is one of a number in the modern southern foundry of one of the world's largest farm implement makers. In other parts of the plant are KIRK & BLUM Systems which remove fumes, dust and chips from various operations.

From this and thousands of other installations in widely varying industries, KIRK & BLUM has gained great skill and knowledge, based on 42 years experience. This experience is at your service. Write for booklet, "Dust Collecting Systems in Metal Industries." The Kirk & Blum Mfg. Co., 2876 Spring Grove Ave., Cincinnati 25, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM
DUST CONTROL SYSTEMS

CHAPTER ACTIVITIES

(Continued from Page 108)

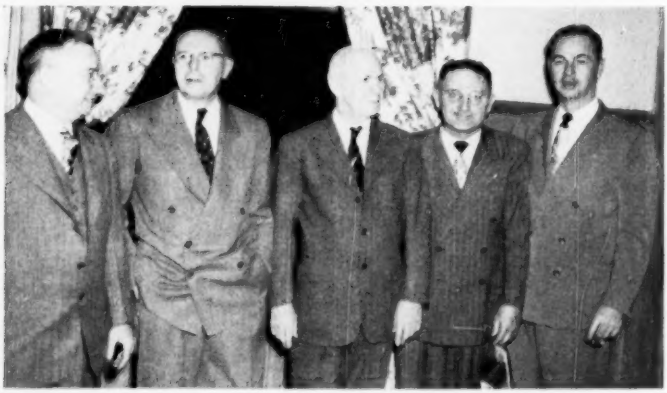
power by filling the Fort Armstrong Hotel ballroom, Rock Island, Ill., with Quad City Chapter members and guests who came to hear M. E. Brooks, Dow Chemical Co., in a down-to-earth discussion of this alloy.

In pointing out the comparative values of magnesium and cerium in making nodular iron, Mr. Brooks said that cerium creates a less violent reaction than magnesium in the ladle but is economically out of proportion to the cost of magnesium additions.

The speaker pointed out that a cupola can be used for the iron source, but in order to do so one must have a knowledge of the reaction and good control in melting. Nodular iron has good fluidity but must have gating designed for its greater shrinkage.

When annealed for two hours a tensile strength of 60,000 psi with 10 to 15 per cent elongation can be expected. Nodular iron offers good properties when designing for shock and high temperatures, he concluded.

Chapter President Earle Shomaker (left), Kay-Brunner Steel Products Co., presents Southern California Chapter championship bowling trophy for 1949-50 to Oliver Greeley, captain of the West Coast Foundry Co. team.



Photographed during the University of Alabama's recent open house celebrating the official opening of the Engineering School's new Foundry Practices Laboratory were, left to right: Birmingham District Chapter Chairman C. P. Caldwell, Caldwell Foundry & Machine Co.; Dean J. R. Cudworth of the School of Engineering and Dr. J. M. Gallalee, president, of the University of Alabama; S. D. Moxley, American Cast Iron Pipe Co.; and Vice-Chairman Morris L. Hawkins, Stockham Valves & Fittings, Inc.

Toledo

R. C. Van Hellen
Unitcast Corp.
Chapter Secretary-Treasurer

RECENTLY-ELECTED officers and directors of the chapter for 1950-51 are as follows:

Chairman, Frank Beierla, Bunting Brass & Bronze Co.; *vice-chairman*, J. A. Mescher, Unitcast Corp.; *secretary-treasurer* (re-elected), R. C. Van Hellen, Unitcast Corp.

Directors (terms expire 1953): Harry Schwab, Bunting Brass & Bronze Co.; Wayne Camp, Freeman Supply Co.; and C. E. Eggenschweiler, Bunting Brass & Bronze Co.

Director (term expires 1952): E. E. Thompson, Unitcast Corp.

Director (term expires 1951): G. W. Davidson, National Supply Co.

Honorary Director: A.F.S. National Director V. E. Zang, Unitcast Corp., Toledo.

Philadelphia

A. J. Saute
Publicity Chairman

APRIL MEETING, attended by approximately 150 members and guests, had as its speaker Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., who discussed the manufacture, applications, heat treatment, etc., of nodular iron. Mr. Kuniansky also presented an interesting film, "*Men and Molds*," dealing with operations in the Lynchburg Foundry Co.

Eastern New York

George E. Danner
American Locomotive Co.
Publicity Chairman

MARCH 21 MEETING, held at Circle Inn, Lathams, was devoted to the subject of gating. Three Naval Research Laboratory films were shown and discussed at the meeting. One was a general film on gating systems, the second had to do with finger gating, and the third with step gating.

These motion pictures were all a part of an investigation to determine the best way to gate a particular casting and to insure uniform flow of metal into the mold with minimum turbulence, thereby tending to produce better castings.

Tennessee

Carl A. Fischer, Jr.
Fischer Supply Co.
Chapter Reporter

REGULAR DINNER MEETING, held March 24 at the Hotel Patten, Chattanooga, was attended by 50 members and their guests. Chairman Karl Landgrebe of The Wheland Co., Chattanooga, presided and Vice-Chairman Paul Arnold, U. S. Pipe & Foundry Co.,

(Continued on Page 119)

Is your company ringing the bell

FOR EVERYONE'S FINANCIAL INDEPENDENCE?

We all can help keep our country economically strong by pulling strongly in the Treasury Department's Independence Drive, May 15-July 4. Obviously this is important to you, because what's good for the nation is good for you and your company.

The purpose of this drive is to increase everyone's financial independence through the regular purchase of United States Savings Bonds. Your "pull" is needed because the greatest share of Series E Bond sales are made through the Payroll Savings Plan—and the Plan (now used by 21,000 companies) thrives best in any company when it gets top management's personal sponsorship.

If your company doesn't have the Payroll Savings Plan, now is certainly the time to install it! It's good "employee relations" to provide this convenience.

If your company does have the Plan, now's the time to put extra push behind it! Employees who pile up money in Savings Bonds feel more secure . . . are actually better workers. Moreover, Bond sales build a backlog of future purchasing power—good "business insurance" for all of us in the years ahead.

The Independence Drive is being powerfully promoted throughout the nation by radio, television, publication advertising, posters, car cards, and special ceremonies. The public is *extra* Bond-concious at this time. Make sure your company adequately informs your employees that the convenience of "automatic" Bond buying is available through your Payroll Savings Plan.

This is your country—so it's *your Drive*. Help to put it over. All the material and assistance you need are available from your State Director, Savings Bonds Division, U. S. Treasury Department. Go into action now!

The Treasury Department acknowledges with appreciation the publication of this message by

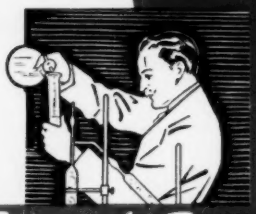
American Foundryman

BOOST BONDS FOR INDEPENDENCE • PROMOTE PAYROLL SAVINGS •

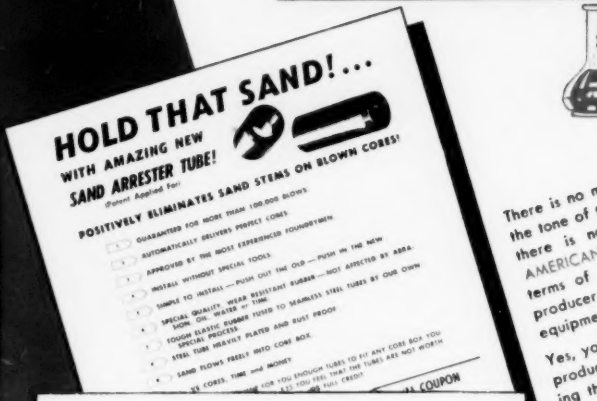
This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

American Foundryman

Compounded to Stand the Test



. . . a fact indicated by unsolicited testimonials from firms using this monthly magazine to reach the "buying influences" of the metal castings field.


HOLD THAT SAND!...
WITH AMAZING NEW
SAND ARRESTER TUBE!
POSITIVELY ELIMINATES SAND STEMS ON BLOWN CORES!
GUARANTEED FOR MORE THAN 100,000 BLOWS
AUTOMATICALLY DELIVERS PERFECT CORES
APPROVED BY THE MOST EXPERIENCED FOUNDRYMEN
INSTALL WITHOUT SPECIAL TOOLS
INSTALL — PUSH OUT THE OLD — PUSH IN THE NEW
SIMPLE TO INSTALL — PUSH OUT THE OLD — PUSH IN THE NEW
SPECIAL QUALITY, WEAR RESISTANT RUBBER — NOT AFFECTED BY ASHA, OIL, WATER or TIME
TOUGH ELASTIC RUBBER FUSED TO SEAMLESS STEEL TUBES BY OUR OWN SPECIAL PROCESS
STEEL TUBE HEAVILY PLATED AND RUST PROOF
SAND FLOWS FREELY INTO CORE BOX
SAVES CORES, TIME and MONEY
COUPON

MARTIN
ENGINEERING COMPANY

KEWANEE 9/13/49 ILLINOIS

Mr. John D. Murray, Adv. Mgr.
American Foundryman
222 W. Adams St.
Chicago 6, Ill.

Dear Mr. Murray:

Enclosed is a schedule of advertisements that our company has decided upon for American Foundryman. Frankly, we are very pleased with results to date. Coupons have been coming in consistently, and we are checking these carefully to gauge the market.

Of those received so far, American Foundryman has a distinct edge in the number of inquiries, with the advantage of an average ratio of 2 to 1 in sales over other publications.

It is on this record that we have decided to expand the schedule, per the enclosed.

Very truly yours,

MARTIN ENGINEERING COMPANY

E. F. Peterson

E. F. Peterson, Pres.

EFP/hh

There is no mistaking results and, from the tone of the letter reproduced here, there is no mistaking the fact that AMERICAN FOUNDRYMAN, judged in terms of results, is the leading sales producer for the marketing of foundry equipment and supplies.

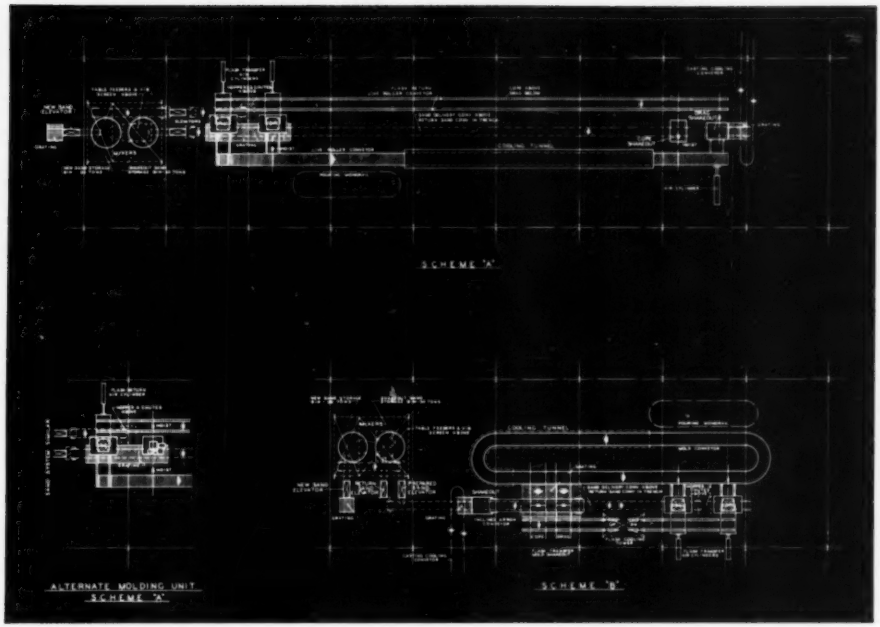
Yes, you've seen this advertisement reproduced in the pages of media reaching the foundry field, and you will be interested to know that the advertiser has kept a close tally on returns. The outcome was conclusive . . . AMERICAN FOUNDRYMAN **outpulled other magazines 2 to 1** in completed sales! This can mean only one thing—AMERICAN FOUNDRYMAN is the magazine that manufacturers can depend upon for results . . . **the kind of results that mean profitable advertising.**

AMERICAN FOUNDRYMAN can "pull" equally as many returns for those firms whose products are suited for use by the thousands of subscriber-members who regularly look to **The Foundrymen's Own Magazine"** as a reliable source of information on the development and production of cast metals.

If AMERICAN FOUNDRYMAN isn't already scheduled for your 1949-50 sales program, it is only **good business** to do so immediately—it costs less than 2c per prospect to reach the readers of AMERICAN FOUNDRYMAN each month with an ad similar to the one reproduced above. Send for full details today!

American Foundryman

222 W. Adams St.,
Chicago 6, Ill.



COMPARATIVE STUDIES

These studies, prepared for a Midwestern foundry, were made to investigate possibilities of low-cost, high-quality production for a specialized product.

The solution to a production problem can quickly be determined by combining the owner's understanding of his methods and practices with the technical ability and experience of Giffels & Vallet, Inc.

Our foundry engineers are available to assist *you*. We will gladly, without obligation, discuss your engineering problems and the assistance we can render.

GIFFELS & VALLET, INC.
INDUSTRIAL ENGINEERING DIVISION
1000 MARQUETTE BUILDING DETROIT

bvb

Means

building ventilation balance

Schneible Engineers now offer dust and fume control with Building Ventilation Balance.

This means balancing *ALL* foundry air . . . air supplied to and exhausted from dust collectors, pouring hoods, mold conveyors, mold cooling hoods, etc., in addition to other processed air, plant heating supply and consideration of normal building leakage. **bvb** is accomplished by means of a metered balancing air supply from both outside and inside the building.

New foundry efficiencies and operating economies are achieved through Schneible's System of Building Ventilation Balance.

SEND COUPON NOW FOR COMPLETE DETAILS

CLAUDE B. SCHNEIBLE COMPANY
P. O. BOX 502, ROOSEVELT ANNEX
DETROIT 32, MICHIGAN

Please send me your new bulletin on bvb without obligation.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

SCHNEIBLE

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Foundry CORE Practice

A Revision of "MODERN CORE PRACTICE AND THEORIES"

. . . dealing exclusively with the production and use of cores in the modern foundry

Fig. 117—Bench-type Core Blowing Machine

Fig. 190—High-frequency Dielectric Core Baking Oven

Written in practical, understandable language for operating men and metallurgists, FOUNDRY CORE PRACTICE covers the entire cycle of core-making operations . . . from materials and mixing methods to final setting of cores and molds.

A complete 560-page handbook, containing 314 photographs, graphs, and sketches, 81 tables and an extensive bibliography, the text covers:

INTRODUCTION
CORE SANDS—TYPES AND LOCATIONS
CORE BINDING MATERIALS
CORE MIXTURES
STORAGE AND CONDITIONING OF CORE MATERIALS
MIXING EQUIPMENT, OPERATIONS, DISTRIBUTION AND STORAGE
CORE MAKING METHODS AND EQUIPMENT
FACTORS AFFECTING CORE BAKING
CORE OVENS AND THEIR CONTROL
CORE FINISHING OPERATIONS
CORE COATINGS
CORE HANDLING
PROCEDURES FOR DETERMINING THE PROPERTIES OF CORES AND CORE MIXTURES
CONTROLLING CORE PROPERTIES
CORE SETTING
CORE KNOCK-OUT
CORE SAND RECLAMATION
CASTING SURFACES AS AFFECTED BY CORE-SAND MIXTURES
ECONOMICS OF CORE PRODUCTION
DEFECTS CAUSED BY FAULTY CORES

Over 100 leading authorities on foundry problems collaborated with the author, Harry W. Dietert, an international authority on sand problems, to pool their knowledge to make FOUNDRY CORE PRACTICE the type of book that will be of maximum benefit to the foundry field . . . available now to AFS members for $6.50; list price $10.00.

ORDER YOUR COPY TODAY

MEMBERS' PRICE . . . $ 6.50
LIST PRICE 10.00

American Foundrymen's Society

616 South Michigan Avenue, Chicago 5, Illinois

Postage paid by AFS when remittance accompanies order.

Please send me promptly ..... copies of "Foundry Core Practice" by H. W. DIETERT.

Date _____

I enclose $ _____ Cash ☐ Money Order ☐ Check ☐ to cover.

Please send invoice ☐

Name _____

Company _____

Address _____

City _____ P.O. Zone _____ State _____

NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 616 S. Michigan, Chicago 5, Ill. Refer to the item by means of the convenient code numbers.

Sectional Conveyor

MY1—Sectional conveyor unit, easily assembled in the field, consists of head (drive) section, tail section and any number of intermediate truss sections forming conveyor of any length up to limitations of belt. Made in widths of 18, 24, 30 and 36 in., intermediate truss sections are 6 ft 6 in., 15 ft 6 in., 18 ft 6 in., and 21 ft 6 in. long by 24 in. deep, and also 24 ft long by 42 in. deep. Transition section 24 in. deep at one end tapers out to 42 in. deep at other, permitting use of both depths on same length of conveyor. Two types of takeups are available: protected screw type for conveyors up to 200 ft long and a vertical gravity type for longer installations. *Robins Conveyors Div., Hewitt-Robins, Inc., Passaic, N. J.*

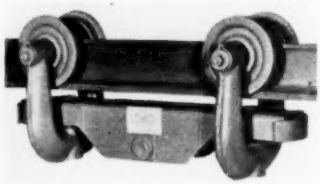
Foundry Bandsaw

MY2—Low cost model 36-L bandsaw is specially designed for removal of gates and risers from all types of castings. A general purpose bandsaw stripped to bare essentials, Model 36-L can be changed to meet individual requirements through addition of refinements. Saw has 36 in. throat

and 20 in. maximum thickness capacity. Main work table is 30 x 36 in. with hand-wheel operated table tilt 45 to right and 5 to left. Auxiliary table is 19 x 19 in. Features are: new aircraft type hydraulic brakes on both saw carrier wheels; complete blade safety guards; adjustable saw guides for blades up to 2 in.; large capacity dust spout for exhaust connection, spring tensioned upper wheel; and 36 in. rubber-tired saw carrier wheels. Unit can be furnished with either direct or belted drive for single speed sawing, or with stepless variable blade speed control over range of 1,000 to 5,000 or 2,000 to 10,000 fpm. Drive motors from 3 to 10 hp may be used to suit power requirement. *DoALL Co., 254 N. Laurel, Des Plaines, Ill.*

Tramrail Trolley

MY3—Improved tramrail trolley for use on hand or electric-powered tramrail systems, transfer bridges and tramrail cranes, eliminates dead parasite weight and reduces rolling friction. Drawbar pull on heavier capacity tramrail trolleys is reduced to 15 lb per ton to start load rolling and 10 lb per ton to maintain momentum. Inbuilt safety features permit taking of shock loads considerably higher than rated capacity. Other features: high strength to weight ratio; free-swiveling trolley yoke; chilled cast iron wheels for reduction of friction losses; and slight



crown in wheel tread which shifts wheel's rolling load in from edge of track, protecting flanges at switches and minimizing peening action on rail. *Forker Corp., 2115 Random Rd., Cleveland 6, Ohio.*

Facing Compound

MY4—Zirkatom, an intermediate-sized zircon facing compound, is claimed by manufacturer to produce finer-grained foundry facings. Particle size of Zirkatom is halfway between standard milled zircon and extremely fine ground, premium-priced special opacifier grades, and is ground to a trace on 325 mesh with an average 50 per cent passing 10 microns. *Foote Mineral Co., 18 W. Chelten Avenue, Philadelphia 44, Pa.*

Pyrometric Controller

MY5—Designed for continuous service in installations where reliability and accuracy are essential, Gardsman Pyrometric Controller is operated by a minute electric current generated by thermocouple in furnace, swings meter pointer to point on scale corresponding to furnace temperature. When temperature reaches desired point, relay system shuts off fuel or current supply to furnace. Unit is powered either by 115 or 230 volt a-c supply. *Taco West Corp., 525 N. Noble St., Chicago 22, Ill.*

Roller Conveyor Top

MY6—A roller conveyor top has been designed for use in movement of extra-heavy loads to and from portable elevating table.

Conveyor top fits snugly over top table surface and is held in place by a flange which encompasses the table perimeter, and may be installed or removed as required without tools simply by positioning or lifting from position. Wedge placed between rollers at each end of load, prevents load from slipping during transit. Tops are also available with rollers mounted at ends. Either style can be furnished with cam-operated roller locking device. Mechanical lift locks table automatically at whatever height stopped. *Hamilton Tool Co., Hanover at 9th, Hamilton, Ohio.*

Grinder Hub Wheel

MY7—Reinforced hub wheel for portable grinders is designed for use on right angle portable grinders and disc sanders in foundry and weld grinding operations. Wheel is reinforced with layers of strong fibrous material between layers of alundum abrasive grain and resinoid bond and has strong composition safety web molded onto back which serves to hold wheel together in event of breakage until machine can be stopped and wheel removed. Rec-

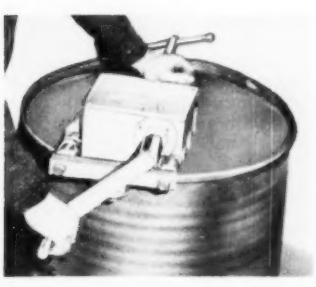
commended by manufacturer for cutting off gates and risers on non-ferrous castings; nicking and notching large gates and risers on all types of castings preparatory to breaking them off; removing mold marks and cleaning castings. *Norton Co., 1 New Bond St., Worcester, Mass.*

Synthetic Resin Binder

MY8—Synthetic thermosetting resin core sand binder is claimed by manufacturer to produce better surface finish, cleaner castings, greater detail and less tendency toward veining, scabbing, spalling, blows and hot tears. Other claims made for Resinox 1816 are savings from higher sand to resin ratios, reduced fuel consumption during baking, increased coremaking capacity and less breakage of stored cores. Wide range of core properties obtained by varying core composition with Resinox includes high tensile strength, high baked permeability, resistance to abrasion, rapid baking without green center, excellent detail and dimensional stability and good collapsibility and shakeout. *Monsanto Chemical Co., St. Louis 4, Mo.*

Drum Head Cutter

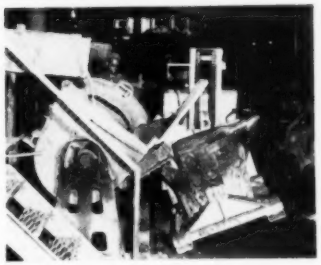
MY9—Approximately one minute is all that is required to cut head of any size



steel drum with manually operated head cutting unit. Cutter will work equally well on empty or filled drums from 10 to 55 gallon sizes and 20 to 16 gage stock. Unit is placed on top of drum, where turn of crank completes cutting circle, causing head to drop into drum. Cut leaves no ragged edges and drum is flanged slightly inward. Blade will make about 1,000 cuttings before resharpening is required. Roller wheel is also available to replace cutting head for sealing of leaky chimes. *Michael A. Schinker Mfg. Co., 6514 S. Western Ave., Chicago 36, Ill.*

Ladle Pouring Fork Truck

MY10—Fork truck equipped with rotating carriage for pouring molten metal moves from flask to flask, pouring molten metal as desired. Single operator rotates ladle to keep constant flow of metal to mold. Unit has two-speed 360 degree rotator. Ladle holds 4,150 lb and cannot fall off truck when tipped for pouring. Truck is an end-controlled fork model of 54-in.



wheel base and 54-in. overall width. The 6,000 lb capacity truck has grade clearance of 3½ in. and 96-in. turning radius. Truck speed is 4 mph under full load and 5½ mph empty. Mast tilts 20 degrees to center load. Rotating device can be replaced with standard forks when desired. *Yale & Towne Mfg. Co., New Haven, Conn.*

Lubricating Oil

MY11—Light colored and carbon free, Safco No. 1250 high-temperature lubricating oil is designed for lubrication of bearings and chains continuously subjected to severe operating temperatures, particularly core oven bearings. Oil when properly applied will "stay put" and lubricate hot bearing surfaces, prevent carbon deposits, keep chains and bearings clean, reduce oil drippage and promote longer bearing, chain and conveyor life. *Swan-Finch Oil Corp., R.C.A. Bldg. West, New York 20, N. Y.*

Porosity Prevention

MY12—Unit for prevention and correction of porosity in castings by low-cost batch immersion methods treats thousands of parts simultaneously in one-hour cycle. Same unit and materials can be used to bond thousands of similar or dissimilar materials to each other in parts requiring high shear and internal pressures. Material and methods approved by Army-Navy specifications. Complete illustrated technical data are available in folder from *Western Sealant, Inc., 9042-46 Culver Boulevard, Culver City, Calif.*

Die Casting Machine

MY13—Designed to provide the die caster with a rugged machine at a low cost is the Model 50. This high-pressure hydraulic machine is equipped with two-stage pump driven by 10 hp direct-connected motor. Pump delivers 13 gal per min at low-pressure stage and 10½ gal per min at high pressure (500 psi) stage. Machine can be furnished either as a cold chamber for casting aluminum or as goose-neck type for casting zinc, tin or lead. Either automatic or manual controls can be supplied. Die plates are 22 x 18 in. Unit has four 2 in. diameter tie bars and can produce aluminum castings up to 2½ lb and zinc castings up to 4 lb. Free cycle time of machine is well over 1,000 shots per hour. *Cleveland Automatic Machine Co., Cincinnati 12, Ohio.*

Chaplet Height Indicator

MY14—Chaplet Height Indicator chooses correct height of chaplets to hold core in large mold. Indicator consists of two telescoping aluminum parts and is available in various heights, ranging from ½ to 8 in. In use, indicators are placed between core and mold surfaces at selected points.

Setting core or closing mold automatically adjusts indicator to correct metal thickness. Proper height of chaplet for each location is accurately maintained by indicator and may easily be read from indicator's scale as it is removed from mold. *Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.*

Reader Service, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago: Please send me literature on the following items circled below, without charge or obligation:

MY1	MY4	MY7	MY10	MY13
MY2	MY5	MY8	MY11	MY14
MY3	MY6	MY9	MY12	

Name ..... Title .....

Company .....

Address .....

City ..... State .....

CHECK YOUR Crucible costs over the past 10 years and you will probably find that while prices generally have gone up 50% Crucible life has increased 60% or more.

As one foundryman puts it, "Crucibles are about the only thing you buy these days that in actual value costs less compared to pre-war days; you get 60% more heats while the dollar cost has on the average risen only 50%."

No other type of non-ferrous melting equipment can show a comparable saving to the foundryman.

Enjoy these savings together with all the other established benefits of Crucible melting.

Write for Crucible
Melters' Handbook

FIRM FACTS

Southwest Research Institute, San Antonio, Texas, has established an office in Paris, France, to facilitate handling of work for European companies and individuals. Directed by Servan G. Cantacuzene, the Paris office will represent the Institute's industrial research service, and will also handle European matters for the **Institute of Inventive Research** and the **Foundation of Applied Research.** All three organizations are Texas non-profit institutions. The Paris office will be located at 207 Rue de L'Universite.

Hyster Co., Portland, Ore., has taken over manufacture and sale of a line of Turret Trucks, formerly produced by the **Salsbury Corp.,** Los Angeles. The line, which includes five horizontal materials handling types—pallet, platform, cargo, tug and auto loader—will be manufactured at Hyster's Danville, Ill., plant.

Rice Pump & Machine Co., Milwaukee, Wis., formerly a division of **Milwaukee Chaplet & Mfg. Co.,** has recently been established as a separate corporation and will continue to manufacture sprue cutters for non-ferrous foundries, die filers and profile grinders and centrifugal pumps. R. D. Houghton, formerly division manager, has been elected president of the new company, with Erwin Losse, formerly division superintendent as secretary, and Robert G. Rice, president of Milwaukee Chaplet, as vice-president. Mr. Houghton will serve as general manager and sales manager, and Mr. Losse will be in charge of manufacturing, engineering and product development. Office and manufacturing operations will continue at the present address.

W. A. Turner, Jeffrey & Co., industrial engineers and foundry specialists of The Manor House, Royston, Hertfordshire, England, announces partnership with E. P. Peregrine. Organization will henceforth be known as **Peregrine and Partners,** incorporating W. A. Turner, Jeffrey & Co., and will operate from the Royston address. Mr. Peregrine comes to Turner-Jeffrey from The Parsons and Marine Engineering Turbine Research and Development Association, where he was chief research engineer.

Major Foundry Co., Inc., formerly located on North Major Ave. in Chicago, has moved to its newly-constructed foundry plant at 9300 W. Belmont Ave., Franklin Park, Ill. Newly-mechanized are molding, cupola charging and materials handling operations for the production of light and heavy gray iron and alloyed iron castings.

New address of the **Osborn Mfg. Co.'s** Detroit office is Room 204 Machinery Bldg., 2832 East Grand Blvd., Detroit 11. Telephone number remains TRinity 5-5984.

CHAPTER ACTIVITIES

(Continued from Page 110)

Chattanooga, was in charge of the evening's program.

A motion picture, *"Chaplets and Chills,"* was shown through the courtesy of Fred H. McGee, Fred H. McGee Co., and a football film was shown courtesy of W. M. Schuler, Birmingham, Ala.

The chairman appointed the following members to serve on the Chapter's Nominating Committee:

Chairman, James L. Payne, Ross-Meehan Foundry Co.; Howard Barker, U. S. Pipe & Foundry Co.; Bert Mullenix, Foundries Supply Co.; J. D. Cliett, Crane Co.; and Charles Chisholm of The Wheland Co.

Northwestern Pennsylvania

Earl M. Strick
Erie Malleable Iron Co.
Chapter Secretary

TWO MEETINGS were held during March—the first on March 17 at Dunkirk, N. Y., and the second at the Moose Club, Erie, on March 27.

At the Dunkirk meeting, Dr. Solomon Simonson, professor of speech at Fredonia State College, Fredonia, N. Y., spoke on "Human Relations," in which he stated that the employer must get "under the skin" of an employee and find out his chief interest in life, then use that subject as a topic of conversation with him whenever possible.

Patting the employee on the back and talking about his family and relations often causes the employee to wonder whether the employer is dissatisfied with his work, Dr. Simonson said.

Following Dr. Simonson's talk, the audience of 75 foundrymen and their guests heard music by the Fredonia College Brass Trio and saw a film on the Himalaya mountains. The film was narrated by Howard Weaver, who was a member of an expedition sent out by the National Geographic Society and Smithsonian Institute to bring back species of rare birds.

Harry Kessler, Sorbo-Mat Process Engineers, St. Louis, spoke on *"Gates and Risers"* at the March 27 meeting. The speaker went into detail on formulae for figuring risers in various sized castings, creating one of the most interesting discussion periods in this chapter's history.

Quad City

R. E. Miller
John Deere Planter Works
Publicity Chairman

COST CUTTING in the core room is a timely topic, judging from the large attendance at the March meeting to hear L. P. Robinson, Werner G. Smith Co., Cincinnati, present an interesting

(Continued on Page 122)

...*First*, because our tests have shown that this bentonite will not attain the high standards of National Bentonite...*Second*, because we do not have to depend on such sub-standard bentonite to maintain our supply.

The bentonite deposits owned by BAROID are so large that we never use any but the highest quality raw material to make *National Bentonite*. These huge deposits, together with BAROID'S careful grading and processing, are your guarantees of obtaining the best in bentonite when you buy *National* from these

APPROVED DISTRIBUTORS

American Cyanamid Co.
New York, New York

The Asbury Graphite Mills, Inc.
Asbury, New Jersey

Barada & Page, Inc.
Kansas City Missouri (main office)
Also—(Branches)
Tulsa, Okla.
Oklahoma City, Okla.
Wichita, Kansas
Dallas, Texas
Houston, Texas
New Orleans, La.

G. W. Bryant Core Sands, Inc.
McConnellsville, New York

Canadian Industries, Ltd.
Montreal, Quebec, Canada
(all branches)

Casco S. de R. L., Mexico, D. F.

The Foundries Materials Co.
Coldwater, Michigan
Also Detroit, Michigan

Foundry Service Company
North Birmingham, Alabama

Foundry Supplies Co.
Chicago, Illinois

Thomas H. Gregg Company
Milwaukee, Wisconsin

Independent Foundry Supply Co.
Los Angeles, California

Industrial Foundry Supply Co.
San Francisco, California

Klein-Farris Co., Inc.
Boston, Massachusetts
New York, New York
Hartford, Connecticut

LaGrand Industrial Supply Co.
Portland, Oregon

Marthens Company
Moline, Illinois

Carl F. Miller & Co.
Seattle, Washington

Pennsylvania Foundry Supply & Sand Co.
Philadelphia, Pennsylvania

Robbins & Bohr
Chattanooga, Tennessee

Smith-Sharpe Company
Minneapolis, Minnesota

Southwest Foundry Supply Co.
Houston, Texas

Steelman Sales Co.
Chicago, Illinois

Stoller Chemical Co.
Akron, Ohio

Wehenn Abrasive Co.
Chicago, Illinois

Mr. Walter A. Zeis
Webster Groves, Missouri

Highest FOUNDRY Quality

National Bentonite

BAROID SALES DIVISION • NATIONAL LEAD COMPANY
BENTONITE SALES OFFICE
RAILWAY EXCHANGE BUILDING • CHICAGO 4 • ILLINOIS

FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Refer to the items by means of the convenient code numbers.

Foundry Dust Control

MY101—A simple "wet water" system for foundry dust control is described in a four-page folder. Requiring no capital investment, system uses Aquadyne, an active and highly concentrated multiphase wetting compound scientifically formulated to reduce surface tension of ordinary water and to increase wettability of all types of dust and powdery materials. Compound is furnished in solidified capsule form for use in blender, where it is dissolved in proper proportion to water passing through venturi nozzle, giving a solution of about 30 dynes surface tension. Ordinary water pressure furnishes power for both proportioning and spraying. *Aquadyne Corp., 220 East 42nd St., New York.*

Temperature Measurement

MY102—Specification sheet describes the Ferrotemp Pyrometer, an accurate portable unit for measuring temperature of molten gray and white iron by immersion of thermocouple in ladle of molten metal. Temperature range of instrument is room to 3000 F, and reading can be taken in 25 seconds for warm ladle to 45 seconds for cold ladle. *Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.*

Aluminum Alloy

MY103—Almag 35, a high-purity virgin aluminum alloy of the aluminum-magnesium type is described in a 12-page folder bound in convenient file folder form. Almag 35 is claimed by manufacturer to have 38,000 to 44,000 psi tensile strength as cast; 10 to 15 per cent elongation as cast; greatest stable shock resistance of any aluminum alloy; four times milling speed of 108, and 16 to 18 times that of gray iron and malleable; superior corrosion resistance; dimensional stability as cast; no heat treatment; and constancy of all properties for life of casting. Folder describes properties and provides information on corrosion tests, applications, permanent mold and die castings. Almag 35 is available in grades for sand, permanent mold and die casting. *William F. Jobbins, Inc., P.O. Box 230, Aurora, Ill.*

Spray Pump

MY104—Spray application of almost every type of liquid material by means of the Alemite Versatal pump is covered in a 16-page brochure showing more than 40 applications of this pump to industry. Among those applicable to the foundry industry are the spraying of core and mold washes, glue and adhesives and paints. Unit is powered by locomotive-type air-powered motor operating pumping piston. Mechanism is similar to bicycle pump, drawing in liquid at bottom of tube and discharging it through surge eliminator at pump outlet directly into supply line. *Stewart-Warner Corp., 1826 Diversey Parkway, Chicago 14.*

Sand Conditioning Machine

MY105—New catalog describes the Model M Sandcutter, a heavily-constructed sand conditioning machine designed for use on medium to heavy foundry floors. Model M was developed to meet foundry needs for a portable, fast-acting, rugged, easily-controlled machine providing thorough low-cost sand conditioning. Model M is built in four standard sizes, with cutting cylinders ranging from 50 in. to 78½ in. length. *American Wheelabrator & Equipment Corp., 3 S. Byrkit St., Mishawaka, Ind.*

Non-Ferrous Alloys

MY106—Described in a 48-page, profusely illustrated brochure are the alloy products, processes and controls of the Niagara Falls Smelting & Refining Division of Continental Copper and Steel Industries, Inc. Division produces aluminum casting alloys in ingot form, copper and nickel base casting alloys, special hardener alloys, deoxidizing and densifying agents for aluminum, copper, and nickel base alloys and alloying agents for iron and steel and fluxing agents. Partial list of more than 100 alloy products is given. *Continental Copper & Steel Industries, Inc., 345 Madison Ave., New York 17.*

Alloy Reference Chart

MY107—A six-page 1950 Alloy Reference Chart contains a comprehensive analysis of stainless, corrosion and heat resisting alloy castings. Listed in detail are alloy types, comparative designations of ACI, AISI, SAE, ASTM and others, plus properties of these alloys at room temperatures, applications, nominal analyses and miscellaneous data on corrosion and heat resistance. *Cooper Alloy Foundry Co., Hillside 5, N. J.*

Safety Equipment

MY108—1950 edition of "Everything in Safety," catalog of personal protective equipment and industrial safety devices, covers respiratory devices, eye protection, hats, gloves, carboy pumps, drum pumps and miscellaneous safety equipment. Catalog is 46-pages, fully-illustrated, and contains price list. *General Scientific Equipment Co., 2700 W. Huntingdon St., Philadelphia 32, Pa.*

Southern Foundry Supplies

MY109—Four-page folder in color describes the facilities of Foundry Service Co. of Birmingham, Ala., for supplying many well-known lines of foundry equipment and supplies to foundries of the South. Listed are more than 19 lines of equipment and 22 lines of foundry supplies, plus industrial sundries carried by this 16-year-old supply house. *Foundry Service Co., Birmingham 7, Ala.*

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2	Aluminum Foundry Process Control (SAE)	1.00	2.50
39	AFS Foundry Apprentice Course Outline	1.00	2.00

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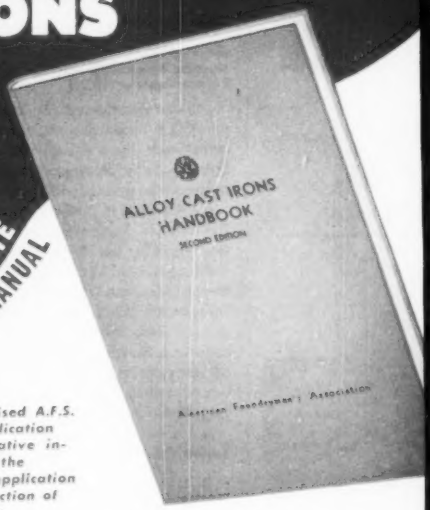

A revised A.F.S. Committee publication of authoritative information on the properties, application and production of alloy cast irons.

This revised edition of the ALLOY CAST IRONS handbook contains a correlation of practical knowledge advanced by outstanding authorities on the production and application of alloy cast irons. The 282 pages of text matter contain 96 tables and 123 illustrations, all dealing with the latest alloy gray iron manufacturing methods.

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ALLOY CAST IRONS is a "must" in the gray iron foundryman's reference library. PRICE: $2.75 to A.F.S. MEMBERS. $4.50 NON-MEMBERS.

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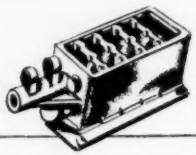

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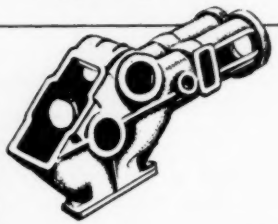

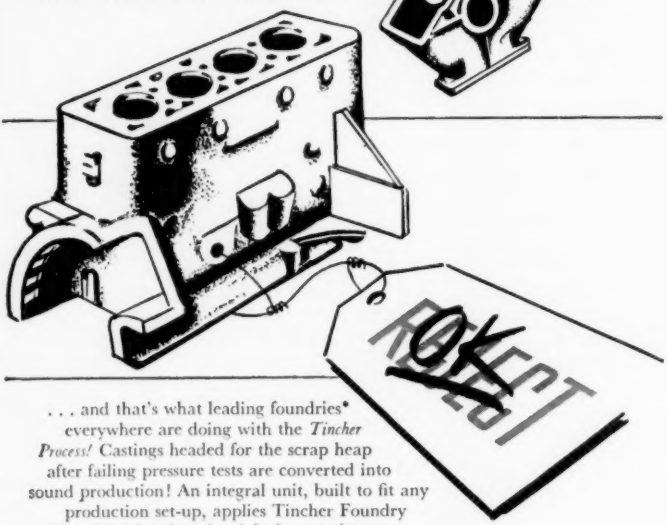

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CHAPTER ACTIVITIES

(Continued from Page 110)

and entertaining talk on that subject.

Important to today's foundrymen, according to Mr. Robinson, are gains that have been made by the fabricating industry. This challenge, he said, can be met only through economy.

The coreroom is often a glaring example of waste because in many cases too much material is used due to bad proportions. The optimum conditions should be sought and combined with scientific mixing, according to Mr. Robinson. All dry materials should be mixed first, then water and, finally, oil. If this sequence is not followed, optimum proportions may not be enough, causing mixing waste.

Chesapeake

Jack H. Schaum
National Bureau of Standards
Chapter Reporter

MARCH 24 MEETING, held at the Engineers' Club, Baltimore, opened with a coffee talk by a prominent Baltimore attorney, who compared crime in Baltimore with that of other U. S. Cities.

E. C. Troy, foundry engineer of Palmyra, N. J., spoke on sand and sand testing. The speaker pointed out the inadequacy of present sand testing methods for determining necessary data. Difficulties experienced with cope fallout, he said, indicate need for a better sand tension test. Thermal conductivity of molding sand mixtures at elevated temperatures would also be a valuable adjunct to present knowledge, he said.

Twin City

J. D. Johnson
Werner G. Smith Co.
Chapter Reporter

OVER 60 MEMBERS and guests attended the March meeting to hear Robert P. Schauss, Illinois Clay Products Co., Chicago, speak on *"Gating and Feeding of Castings."*

Mr. Schauss outlined three considerations in the satisfactory solution of the gating problem. They were as follows:

(1) Metal should flow through the gating system with a minimum of turbulence and a choke effect should be maintained to prevent the entry of dirt and slag into the mold cavity.

(2) Metal should enter the mold so that temperature gradients, produced on the surface of the mold and in molten metal within the cavity, are directional toward feeders.

(3) Gating and feeding should be commercial.

With regard to feeding, three methods were given to supply molten metal to compensate for shrinkage:

(1) Metal which solidifies during

the filling of the mold cavity will automatically receive sufficient metal to compensate its volume change.

(2) One section of a casting may draw liquid from another section if the rate of solidification of one section is more rapid than the rate of solidification of the other section.

(3) External reservoirs (feeders or risers) may be used, but the rate of solidification of these must be slower than that of the section which they are feeding.

Additional feeding ideas were presented and explained including the use of atmospheric pressure risers and "necked-down" risers.

Central Indiana

William K. Mitchell
L. W. and W. K. Mitchell
Chapter Reporter

PERENNIAL FAVORITE on the year's program, the Question and Answer Panel, was the feature attraction at the April 3 meeting, held at the Athenaeum, Indianapolis and attended by 90 members and their guests.

J. P. Lentz, International Harvester Co., Indianapolis, served as chairman of the meeting. The panel of experts included G. C. Dickey, Harrison Steel Castings Co., Attica, Ind. and Fred Kurtz, Electric Steel Castings Co., Indianapolis, in the Steel Castings section; Harold Lurie, Cummings Diesel Engine Co., Columbus, Ind., and Minor Carpenter, International Harvester Co., Indianapolis, Gray Iron section; William Zeunick, National Malleable & Steel Castings Co., Indianapolis, James Barrett, National Malleable & Steel Castings Co., Indianapolis, and Carl Schopp, Link-Belt Co., Indianapolis, Malleable section; and Paul Lee Hargitt, Light Metals, Inc., Indianapolis, and Norman Baker, Non-Ferrous Foundries, Inc., Indianapolis, Non-Ferrous section.

Ohio State University

Dallas M. Marsh
Publicity Chairman

GUEST SPEAKER at the April 4 meeting was Wilfred H. White, Jackson Iron and Steel Co., Jackson, Ohio, who spoke on "The Gray Iron Industry."

Mr. White pointed out that many of the foundries in business today are in need of systems for controlling their operations in order to produce high-quality castings consistently.

In some of these foundries operating costs could be reduced considerably through the purchase and use of relatively inexpensive laboratory equipment, he said.

The existence of such conditions, said Mr. White, presents a challenge to the student members of A.F.S., who will soon be entering the foundry industry. Each of these foundries represents a potential job opening for the graduating engineer who can present to the foundry operator methods for controlling operations to reduce scrap losses and maintain quality standards.

Mr. White concluded by stating that "drive" and the application of methods of control in the foundry can help the graduating engineer to secure success for himself and for the foundry which employs him.

Candidates for election to chapter offices were nominated during the business session. Chapter Member John Matyskella was presented the monthly awarded for service to the chapter.

Ontario

C. H. Johnston
E. Long, Ltd.
Chapter Director

FINAL TECHNICAL MEETING of the 1949-50 season was attended by almost 300 members and guests. Honored at "Past Chairmen's Night" were six past chapter chairmen and Guests Walton L. Woody, A.F.S. National President; E. N. Delahunt, Warden-King, Ltd., Montreal; and James Newman, chairman of the A.F.S. Eastern Canada Chapter.

New officers and directors are:

Chairman, M. N. Tallman, A. H. Tallman Bronze Co., Ltd., Hamilton;

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vice-chairman, R. H. Williams, Canadian Westinghouse Co., Ltd., Hamilton; *secretary-treasurer* G. L. White, Westman Publications, Ltd., Toronto.

Directors (to serve three years): George Winkworth, Toronto Foundry Co., Toronto; Fred J. Rutherford, Refractories Engineering and Supplies, Ltd., Hamilton; Charles Thompson, Galt Malleable Iron Co., Ltd., Galt; and T. Lyons, Empire Brass Mfg. Co., Ltd., London, Ont. Elected a director to serve one year was Immediate Past Chapter Chairman J. H. King of Werner G. Smith, Ltd., Toronto.

The speaker of the evening was E. T. Kindt, Kindt-Collins Co., Cleveland, Ohio, who spoke on "*The Promotion of The Pattern Industry.*"

The importance of the patternmaker to all industry was pointed out and the speaker showed that lack of cooperation in the castings industry leaves the gate wide open to other methods of manufacture—the pattern shop and the foundry must work together, he said.

While the pattern industry is a relatively small part numerically of the casting industry, the craft is also incidental to other trades and the industrial revolution of the 19th century forced recognition of the craft, he said.

The foundry industry is the fifth largest industry in both the United States and Canada and cannot exist without the pattern engineer, as he is responsible for all patterns and foundry production toolage, Kindt declared. Good patterns and equipment are needed if a foundry is to remain in business. Some essentials are proper materials, good engineering, good tools, and good housekeeping, he said.

Mr. Kindt outlined the kind of pattern shop he considers essential to meet present day pattern requirements and dealt with the proper method of figuring pattern costs, stressing the importance of considering the cost of the end product rather than the initial pattern equipment cost.

The need of an educational program in pattern selling and engineering was strongly advocated. The speaker remarked that "standardization" is a tough problem but should be tackled vigorously as a means of improvement.

There is a demand for better and more accurate patterns and the consideration of new materials is essential as the supply of suitable wood for patterns is becoming scarce, he added.

Following Mr. Kindt's talk a film on pattern materials and pressure cast pattern equipment was shown.

Birmingham District

J. P. McClendon
Stockham Valves & Fittings
Chapter Reporter

Open-house on Friday, March 24, turned the University of Alabama into a beehive of activity, as foundrymen and special guests inspected the University's new Foundry Practice Laboratory, one of the outstanding attractions of the all-day program.

Visitors witnessed conditioning of sand, ramming-up of molds to receive molten metals, cupolas being charged and tapped.

"Safety first" is one of the first principles of the foundry industry and it was good to see that it is not only taught at the University but is practiced by the students in the Laboratory. Goggles, leggings and safety shoes were in evidence as students tapped, shanked and poured molten metals. Overhead cranes and suspended ladles facilitated pouring of metal.

Net results after shaking out, cleaning, grinding and polishing were a number of souvenir ashtrays, showing the University seal.

Following the open house and inspection tours, more than 100 foundrymen gathered at Tutwiler Hall for a dinner, with Dean Cudworth of the School of Engineering serving as toastmaster and Dr. J. M. Gallalee, University president, as dinner speaker.

Others at the speakers' table were: Dean Newman of the Administration

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Michiana

J. P. Jordan
Dodge Mfg. Corp.
Secretary-Treasurer

APRIL MEETING was planned to appeal particularly to brass and bronze foundrymen, but was of interest to all foundrymen attending. Speaker for the evening was William Romanoff, H. Kramer & Co., Chicago. Speaking on "*Brass and Bronze Foundry Practice*," Mr. Romanoff pointed out some of the troubles encountered in brass and bronze founding and suggested ways and means of eliminating these troubles. High strength brasses and bronzes were discussed and potential uses for these were pointed out.

H. K. Nelson, Nominating Committee Chairman, announced the results of the chapter election. The following Chapter officers were elected:

Chairman, William Ferrell, Auto Specialties Mfg. Co.; *Vice-Chairman*, Stanley Krzeszewski, American Wheelabrator & Equipment Corp.; *secretary-treasurer*, V. C. Bruce, Frederic B. Stevens, Inc.

Directors: Matthew Goodall, Dodge Mfg. Corp., Roy Payne, Sterling Brass Foundry, Kent Wonnell, Peru Foundry Co., Leslie Pugh, Casting Service Corp.

Chairman Vern Spears announced that a meeting had been held with the Central Indiana Chapter and the members of the Purdue University faculty to plan the Metals Casting Conference for 1950, the date has been set for November 2-3. This conference is sponsored by Purdue University with the cooperation of the Central Indiana and Michiana Chapters of the American Foundrymen's Society.

Southern California

W. G. Stenberg
U. S. Electrical Motors, Inc.
Publicity Chairman

LARGE NUMBER of members and guests were present at the April 14 meeting to hear L. P. Robinson of the Werner G. Smith Co., Cleveland, speak on "*Cutting Costs in the Coreroom*."

The speaker stressed the importance

COMPLETE SAND CONDITIONING WITH MAGNETIC SEPARATION
in one portable unit
End section of Preparator at discharge point.
Here tramp iron is discharged from machine into scrap box . . . an exclusive Preparator feature.
Newly designed and streamlined, the Preparator provides your foundry with an efficient, dependable, heavy duty, portable sand conditioner. This one machine screens, breaks lumps, magnetically separates, aerates, and discharges sand up to 35 feet into pile or bin. Load centered trunnions permit easy movement by crane. Rugged construction assures years of service, even with the roughest of treatment. Completely conditions up to sixty tons of sand per hour!
the PREPARATOR
HOW IT OPERATES
Preparator easily tilted on Trunnions [1]—and moved to any desired location by crane. Shakeout sand is loaded by crane bucket or loader into large open top hopper [2] and feeds through adjustable gate opening [3] onto heavy duty Gyratory Screen [4] equipped with adjustable lump breaker [5]. Screened sand drops onto belt conveyor [6] and passes over magnetic pulley [7] which separates tramp iron into scrap box [8]. The cleaned sand falls onto drum type aerator [9] which discharges it to any distance up to thirty-five feet. The adjustable deflector plate [10] controls the distance the sand is thrown. The water spray [11] at discharge point, provides final tempering.
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of analyzing the costs in the core room and pointed out that doing so would result in a more competitive position. The main items which should be watched in order to reduce core room costs were listed by Mr. Robinson as follows:

(1) Core blowing is a method suggested in order to reduce the time required to make cores and to produce better cores. To use a core blower, a reasonably long run should be assured to warrant the cost of rigging.

(2) Accurate core mixture measuring is important. The measuring of core mixtures by the use of scoops, shovels, etc. is very inaccurate. Good cores, made economically, should be made by accurately measuring the core mixture in pounds.

(3) A good sand core mixture can reduce and maintain a lower average weight per casting. This lower weight saves costs of material, resulting in casting cost savings.

(4) The quantity of cereal binder was mentioned as another place to save costs. Most foundries use too much, forgetting its cost. Use that amount that gives the proper amount of green strength and no more.

(5) Get the proper type of sand and stay with it.

(6) Have a dependable employee mix the core sand. A dependable employee on this operation can save costs and prevent errors.

(7) Proper oven temperature control is important as it is a cost saver against fast bakes, burned cores, too much moisture, etc.

(8) A proper inspection should be given all cores. If there is a question after inspecting a core, it is better to junk the core than to use it.

Preceding the dinner three motion pictures were shown through the courtesy of the Naval Research Lab. These pictures were *"Gating Systems for Metal Castings," "Finger Gating,"* and *"Step Gating."*

Chapter President Earle Shomaker, presented the bowling trophy to the winning team in the 1949-1950 Chapter Bowling Tournament.

This tournament was won by the West Coast Foundry Co. with a record of 74 wins and 33 losses. Oliver Greeley, team captain, accepted the award from Mr. Shomaker in behalf of the team. This team consisted of Mr. Greeley, Amos Culp, Ray Rozelle, Jack Stearns, and Ray Walling.

Leonard Hofstetter, Chairman of the Nominating Committee, announced the nomination of the following officers to serve for the coming year: John Wilson, Climax Molybdenum Co., *President;* Henry Howell, Howell Foundry Co., *vice-president;* Harold Pagenkopp, Angelus Pattern Co., *secretary;* and A. L. Goodreau, G. B. Brass and Aluminum Foundry, *treasurer.*

Charles W. Hauk, retired, formerly with General Motors Corp., and a member of the A.F.S. Saginaw Valley Chapter, was a meeting guest.

Central New York

John A. Feola
Crouse-Hinds Co.
Publicity Chairman

APRIL DINNER MEETING, held at Cornell University, April 14, opened with a coffee talk by George K. Dreher, executive director of the Foundry Educational Foundation, who described the Foundation's accomplishments, aims, and future policies.

Following Mr. Dreher's talk, Prof. Peter E. Kyle of Cornell University described Cornell University's part in the FEF program and stated that 20 students are participating.

Professor Kyle introduced two FEF scholarship students, N. Sheptak and R. L. Folkman, who described their summer foundry work experiences, which, they said, benefited them materially in their education.

Principal speaker of the evening was William M. Ball, Jr., R. Lavin & Sons, Inc., Chicago, who spoke on *"Non-Ferrous Castings."*

Mr. Ball started his talk by pointing

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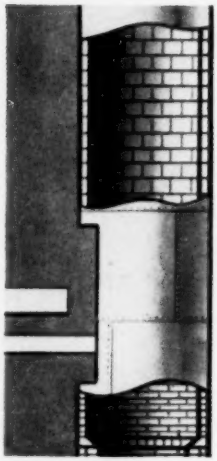

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★ **Ladle Lining Refractory**
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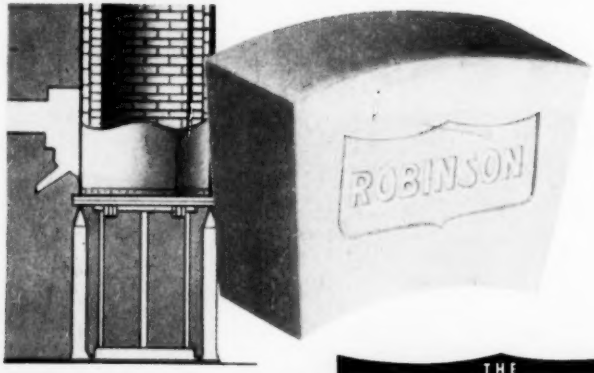

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out that it was possible to produce good castings without all the "super-duper" ideas that are sometimes deemed necessary. He stated that in very many cases a thorough check on the facilities at hand are all that is required.

To prove his statements, the speaker started at the drawing board and progressively followed a casting through the core department, foundry and cleaning room, citing examples in each step that showed how good control and a little common sense could prevent many of our foundry difficulties from occurring. One of the main reasons for pride in the foundry industry, he stated, is the fact that practically all other crafts are dependent on the foundry and without castings the world would soon revert to the Dark Ages.

Most of the Foundry Educational Foundation students at Cornell attended the dinner and technical session.

Place Mobile Air Pollution Laboratory In Service

PENNSYLVANIA'S new air pollution and industrial hygiene mobile laboratory, only one of its type in the country, has just been placed in service by the state's Bureau of Industrial Hygiene. Equipped with more than 25 devices for field sampling and quantitative and qualitative analyses of atmosphere in industrial communities and factories, the laboratory is expected to play an important part in the state's effort to keep the atmosphere in industrial communities free from hazardous or annoying fumes, dusts, and gases.

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INTENDED TO SMOOTH the way of salesmen and other visitors to Belle City Malleable Iron Co., and Racine Steel Castings Co., both Racine, Wis., is a leaflet "Welcome to Belle City." The leaflet is designed to make calls at these plants more pleasant and fruitful.

Contained in the little publication are the names of officers and department heads, a brief commentary on what the plants produce, a listing of various conveniences such as telephone, washrooms, cafeteria, and transportation, and a condensed history of the companies. A map of Racine locates not only Belle City Malleable Iron Co. and Racine Steel Castings Co., but also a number of other companies and sites of interest to visitors.

Survey Australian Foundry Sands

RESULTS OF A SURVEY of New South Wales foundry sand resources is reported in CSIRO Bulletin 239 just issued. Jointly undertaken by the Commonwealth Scientific and Industrial Research Organization, East Melbourne, and the NSW Department of Mines, the project covered pits now in use and deposits which may be worked in the future.

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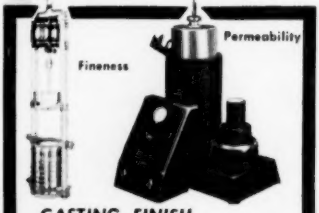

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PERSONALITIES

(Continued from Page 101)

29 in San Francisco. Other officers elected were: **James W. Dunham**, vice-president, National Cylinder Gas Co., Chicago, vice-president; **E. V. David**, assistant manager, technical sales division, Air Reduction Sales Co., New York, re-elected treasurer; and **A. F. Reinhard**, re-elected secretary.

Newly appointed representatives for the Ayers Mineral Co., Zanesville, Ohio, are **James R. Hewitt, Jr.**, who will handle the company's line of molding sands in the Southwest; and **Walter Zeis** of Webster Groves, Mo., who will handle the company's St. Louis and Kansas City areas.

Robert H. Davies has been elected vice-president and general manager and **Edward H. Remde** vice-president of the Baker Industrial Truck Division of the Baker-Raulang Co., Cleveland. Before joining Baker last year, as manager of engineering, Mr. Davies was production engineer for the Lockheed Aircraft Corp.; in charge of production for Northrop Aircraft, Inc.; and plant engineer in the building of Henry J. Kaiser Co.'s alloy plant, ferro-silicon plant and magnesium sand casting foundry; and was superintendent of Kaiser's Permanente, Calif., plant. Mr. Remde this year completes 50 years with Baker-Raulang.

J. R. Cochran, formerly foundry metallurgist with the Neenah Foundry Co., Neenah, Wis., has been named technical assistant for Reading Gray Iron Castings, Inc., Reading, Pa. Holder of a B.S. in Chemical Engineering from the University of Illinois, Mr. Cochran has served as metallurgist for New York Air Brake Co., J. I. Case Co., Sundstrand Machine Tool Co., and Hansell Elcock Co.

Expansion of Magie Bros., Chicago, petroleum products firm, into the industrial lubricants field will be headed by **Samuel W. Bodman, Jr.**, as sales manager, with **Arthur I. Thuren** and **John P. Sipp** as sales representatives. All three men have for several years been associated with various firms in the sale of foundry core oils.

OBITUARIES

Dr. Fritz Meyer, director of foundries, Sulzer Brothers, Zurich, Switzerland, died early this year. Dr. Meyer, whose father was for many years an executive of Sulzer Brothers, became acquainted with foundry work while still a boy. Upon completion of his studies at the Technical University, Aachen, Germany, Dr. Meyer joined several U. S. firms as a consultant, returning to Zurich to become director of foundries for Sulzer Brothers some seven years later.

Alphonse O. Rousseau, abrasive products safety engineer for the Norton Co., Worcester, Mass., died March 27 at the age of 61 following a brief illness. Mr. Rousseau, who was chairman of the Grinding Wheel Institute's Safety Committee, was a frequent speaker on safety topics before meetings of technical societies.

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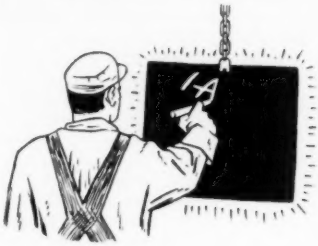

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ABSTRACTS

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Steel Foundry Molding

38—Equipment Types. John Howe Hall, "Flasks and Rigging for Steel Castings," Pt. I and II, *Foundry*, vol. 78, Jan. 1950, pp. 70-73, 205-208; Feb. 1950, pp. 98-99, 135, 137-138.

The various types of flasks, jackets and bottom boards which are used in the steel foundry for making different size castings are described. Also discussed are methods of calculating the lifting force of molten metal on the cope and cores.

Production Control

39—Setting up System. T. H. Wood, "Application of Production and Methods Control to Foundry and Pattern Shop," *The Engineer and Foundryman*, vol. 14, Dec. 1949, pp. 57-63.

The author presents several points illustrating the advantages of a production control system and discusses setting up such a system for a foundry turning out 200 tons per week. The necessary paper work is described along with an "At-a-Glance Control Board." Three of these are shown, and a flow chart is illustrated and described.

Steel Foundry Production

40—Raw Materials to Finished Casting. W. H. Worrilow, "Production of High Alloy Steel Castings," Pt. I and II, *Steel*, vol. 126, Feb. 13, 1950, pp. 89-96; Feb. 20, 1950, pp. 91-94, 102-105.

The various steps in the production of steel castings are discussed, including inspection of the raw materials to the heat treating of the finished castings. High stainless heat-enduring and corrosion resistant alloy castings are discussed, along with those containing reasonably high percentages (8 per cent or more) of nickel and chromium. A brief account of the development of stainless alloys is included.

Nodular Iron Applications

41—Chemical and Mechanical Properties. "Nodular Graphite Cast Iron. How Will It Affect Australian Foundrymen?" *The Australian Foundry Trade Journal*, vol. 1, Dec. 1949, pp. 4-9.

Several tables are presented showing the effect of silicon and magnesium on low and high sulphur irons, effect of adding magnesium alloys to high and low carbon,

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34 Osborn Squeezers, Model 275J, 10" Cylinder. Age: 1945.

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low phosphorus irons, and the effect of inoculation, holding time and section size on the chemical and mechanical properties of nodular graphite irons. Many immediate applications of this material are discussed along with its possible use in high strength applications which are now filled by alloy-type irons.

Precision Cast Magnesium

42—Structures and Properties. W. F. Davenport and G. W. Orton, "Investment Casting Magnesium," *Iron Age*, vol. 165, Feb. 15, 1950, pp. 94-96.

Investment casting of magnesium alloys AZ63 and AZ92 are described. Microstructures and mechanical properties of the two alloys are compared when sand or investment cast.

Non-Ferrous Melting Furnaces

43—Early and Modern Types. H. Leusink, "Metal Melting Furnaces," *Metalen*, vol. 4, Jan. 1950, pp. 81-88 (in Dutch).

Several early non-ferrous melting and alloying furnaces are illustrated and described along with the most modern types now employed in the industry.

Alloy Steels Heat Treatment

44—High Impact Values. N. A. Ziegler and W. L. Meinhart, "Effect of 1150 F Aging on Cr-Mo Steel Castings (2.5 to 9% Cr)," *Metal Progress*, vol. 57, Feb. 1950, pp. 203-207.

Mechanical properties and microstructures of several analyses of chromium-molybdenum and chromium-molybdenum-nickel steel castings are presented and discussed. Charpy impact values indicate that the chromium-molybdenum alloys without nickel give considerably higher results when tested at −25 F, +70 F and 1000 F.

Gas Porosity

45—Analytical Method Developed. Y. Dardel, "Hydrogen in Aluminum. Method of Determination—Effect on Pore Formation," *Metal Industry*, vol. 76, Mar. 17, 1950, pp. 203-206.

The effects of gas porosity formed during solidification, heat-treatment and welding are discussed along with a method for the determination of the hydrogen content in the metal. A diagram of the apparatus for hydrogen determination is shown. A chart for determining the volume of the gas from the pressure is included.

Steel Solidification Factors

46—Crystallization Center Distribution. D. R. F. West, "The Mechanism of Solidification of Horizontal Steel Castings," *Journal of the Iron and Steel Institute*, vol. 164, Feb. 1950, pp. 182-194.

An investigation was made to determine the factors which influence the macrostructures of horizontally cast steel blocks, with special reference to temperature conditions and rates of solidification. Rates of solidification from the upper and lower surfaces of castings were varied by placing chills of copper and iron on these surfaces, and the resulting macrostructures were

examined. Determinations of temperature conditions during solidification of sand and chill castings were made by inserting thermocouples into the mold cavity and measuring the temperatures at intervals after pouring, using a selector switch and a high-speed recorder. The liquidus-solidus ranges of some commercial steels solidifying in the form of castings were investigated, and temperature gradients and rates of solidification from the upper and lower casting surfaces, for various degrees of superheat, were determined. Solidification rates were also determined by the pour-out method. The main factor influencing the macrostructure was concluded to be the distribution of centers of crystallization in relation to the rate of solidification. The gravity settling of crystallites was considered to be of particular importance in determining the distribution of these centers.

Three-Part Pattern

47—Construction Method for Large Casting. C. W. Gilchrist, "Production Casting 30-Ton Engine Bases," *Iron Age*, vol. 165, Mar. 2, 1950, pp. 81-85.

The making of an experimental 30-ton engine block casting is described along with a discussion on the methods employed in making the same casting on a production basis. The production pattern was split in such a way as to allow the flask to be made in three pieces. This consisted of a bottom drag, a cheek, and a cope. A portable recirculating-type mold drier was employed since the completed mold exceeded the capacity of the crane and could not be transferred to an oven.

Metal Polishing

48—Method Covers Many Metals and Alloys. A. L. De Sy and H. Haemers, "The Electrolytic Polishing," *Metalen*, vol. 4, Mar. 1950, pp. 129-137 (in Dutch).

The theory and the procedures of the electrolytic method of metal polishing are described. Many metallographic photographs illustrate the results obtained in the electrolytic polishing of iron, steel, aluminum and its alloys, and copper and its alloys. Twenty references.

Nickel In Brass and Bronze

49—Establish Optimum Contents. J. S. Vanick, "The Part Played by Nickel in the Casting of Copper Alloys," *Founderie*, Feb. 1950, pp. 1941-1953 (in French).

Effects of the presence of nickel on the properties of bronze, brass and other copper alloys are studied systematically. The optimal nickel contents in alloys of various composition and of various mechanical properties are established, and the frequently observed tendency in foundry practice to limit the Ni contents is criticized.

Foundry Conveyor Systems

50—Make Wide Size Range. C. H. DeLamater, "Mechanized Job-Shop Foundry for Aluminum," *Mechanical Engineering*, vol. 72, Mar. 1950, pp. 211-215.

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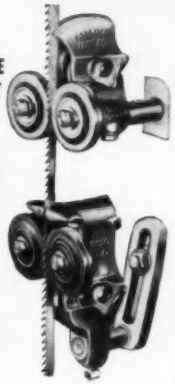

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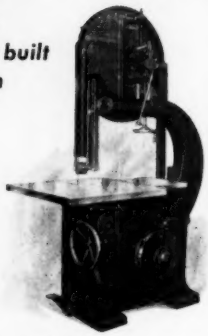

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ry is described. A conveyor system handles the flow of material between four main buildings (380,000 sq ft of floor space). Several different conveyor systems are employed, including mold conveyor trains in the sand foundry, an overhead monorail system for handling molten metal, overhead and underground belt conveyors for transporting molding sand, and an elaborate power- and free-conveyor system for moving cores, castings, and scrap. The foundry produces both sand and permanent-mold aluminum alloy castings in weights from a few ounces to several hundred pounds.

Steel Test Block Design

51—Separately Cast Test Pieces Best. H. T. Protheroe, "Steel Castings Test Blocks: A Review of Available Data," *Iron and Steel*, vol. 23, Mar. 1950, pp. 79-84.

A critical analysis is made of the results of tests from differently designed test-blocks. Some of the test blocks described are the keel block, Kain and Dowson cloverleaf, and the Wayne, Bishop and Taylor multiple test block. Separately cast test pieces are better criteria of steel quality than tests pieces cut from the casting. Several tables and references are included.

Synthetic Resin Core Binder

52—Mixture for Iron Foundry. Curt Nilsson, "Carbamide Resin as a Core Binder," *Gjuteriet*, vol. 40, Feb. 1950, pp. 17-21 (in Swedish).

The use of the carbamide resin (urea-formaldehyde) as a core binder, recently introduced in the foundry practice in Sweden, is discussed. The author describes his experiments in the laboratory and in the plant. The mixture recommended for general cast iron work is 100 parts of sand, 1.25 parts of resin (50 per cent aqueous solution), 1.75 parts of flour, and 0.25 parts of kerosene (all by weight).

Copper-Lead Casting Problems

53—Practical Methods. P. D. Liddiard and P. G. Forrester, "Casting Copper-Lead Alloys. Theoretical Aspects—Practical Problems," *Metal Industry*, vol. 76, Mar. 3, 1950, pp. 163-165; Mar. 10, 1950, pp. 191-193.

The copper-lead equilibrium diagram is given and the general alloy types are discussed. Some of the problems encountered in casting the alloys are described along with a discussion regarding lead dispersion. Practical methods of producing copper-lead linings by casting are presented, as well as a description of the casting problems and the effect of other constituents on the final structure.

Steel Foundry Training Plan

54—Practices Reviewed. "Foundry Solely for Training Staff. Interesting Report from Germany," *The Australian Foundry Trade Journal*, vol. 1, Dec. 1949, p. 10.

A review of German steel foundry practices is given along with a description of a completely equipped foundry employed by one large steel foundry solely for the purpose of training inexperienced help.

Operation Tulsa . . .

(Continued from Page 87)

3. Snap and Machine Molding
4. Cupola and Furnace Melting Practices
5. Analysis of Casting Defects
6. Blueprint Reading and Weight Estimation
7. Safety and Good Housekeeping
8. Metallurgy and Metallography

The subjects were arranged in the order that most foundry workers would ordinarily become acquainted with them and a training program started.

Fred Havens, a journeyman molder with over 30 years experience, was suggested by the committee as a teacher and certified by the State Board for Vocational Education.

Instruction is made interesting and informative by inclusion of educational aids such as motion pictures and special guest speakers, supplied through the cooperation of the foundry supply companies, who explain technical phases of the industry. Much of the discussion is centered around the problems of production which are encountered by workmen in the local foundries.

Records are kept on attendance and, at the close of each course, certificates are issued for satisfactory participation. Records are filed in the offices of the Tulsa Public Schools and in the Division of Trade and Industrial Education, State Board of Vocational Education, Stillwater, Okla.

Approximately half of the cost of the class instruction is paid by the local Board of Education and the State Board of Vocational Education and the balance of the cost is shared equally by the employers and the local union.

The classes are free to any foundry employee who wishes to attend and are compulsory for all apprentices. The apprentices must be approved by the apprenticeship committee before being issued a journeyman card by the local union.

Representing management on the Foundry Education and Apprenticeship Committee are: J. A. Dean, chairman, manager of NEMCO Foundry; William Harris, iron foundry superintendent, Frank Wheatley Pump & Valve Mfg. Co.; Morrie Hellander, vice president, Empire Foundry & Pattern Co.; and Floyd Cooper, owner, Mohawk Foundry. Labor representatives on the committee are: B. W. Davie, president, International Molders & Foundry Workers Union of N. A., Local No. 325, and secretary of the committee; Leon Pendergraph; James P. Mitchell; and Fred Havens.

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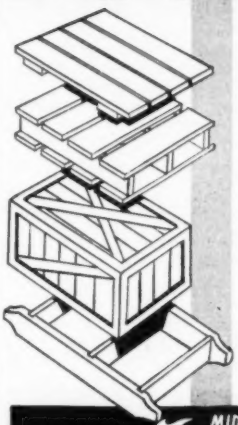

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Non-Ferrous Foundry Practice

54—Gas Absorption. M. Stap. "The Smelting and Casting of Non-Ferrous Metals," *Metalen*, vol. 4, Feb. 1950, pp. 114-118 (in Dutch).

A general outline is given of the peculiarities of foundry operations with non-ferrous metals and their alloys, as compared with procedures used in iron foundry work. Most of these peculiarities are due to the phenomenon of gas absorption, prominent in several non-ferrous metals. Several procedures are mentioned, which aim at minimizing oxidation of the metal by air during smelting and casting.

Investment Casting Tolerances

55—Dimensional Variations. T. F. Frangos, "Design Factors in Investment Casting," *Tool Engineer*, vol. 24, Apr. 1950, pp. C-38—C-40.

The author discusses the use of plastic or wax injection in the investment casting process. On small volume runs, wax injection is more economical. On production runs of 5,000-10,000 pieces, plastic injection is recommended because of the lower per-piece cost of castings. The tolerances held vary with size and shape, but casting tolerances of plus or minus 0.005 in./in. generally are held. Several graphs are included showing the frequency distribution of dimensional variations in some small parts. Casting of undercuts and holes in the production parts is also treated in this article.

Nodular Iron Developments

58—High Elongation Obtained. O. Carlsson, "New Data on Nodular Cast Iron," *Gjuteriet*, vol. 40, Mar. 1950, pp. 31-37 (in Swedish).

Nodular cast irons were produced by remelting Swedish charcoal pig iron with CuMg (20 per cent Mg) or NiMg (25 per cent Mg). In one case the sulphur content was raised to 0.035 per cent, and the Cu-Mg treatment was followed by a strong inoculation corresponding to a 1 per cent increase in the silicon content. A maximum tensile strength of 80,000 psi and elongations up to 14 per cent were obtained. The costs were approximately equal to those of malleable iron.

Reading Founders Have Double Bill

Reading Foundrymen's Association members had their choice of speakers on non-ferrous and on nodular iron castings at their March meeting according to the organization's secretary W. I. Cassidy. Speaking on "*Making Better Non-Ferrous Castings*" were R. A. Colton and D. L. LaVelle, Federated Metals Div., American Smelting & Refining Co., Barber, N. J. They dealt with brass and aluminum foundry problems, centering their discussion on cause and cure of defects.

Ferrous casting group speaker was W. R. McCracken, Cooper-Bessemer Corp., Grove City, Pa., whose subject was "*Nodular Cast Iron.*"

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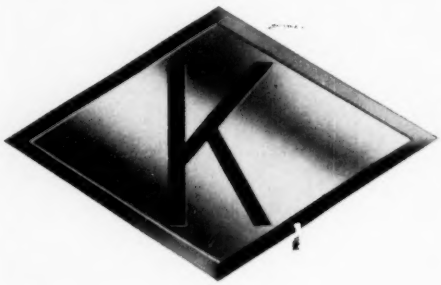

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Fees listed include those for tests on pyrometers, fuels, mechanical instruments, optical instruments, electrical standards and instruments, standards of length, mass, and time, and radioactive standards. NBS Circular C483, 93 pages, is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 25 cents a copy.

Index to Advertisers

	Page
American Colloid Co.	124
Baroid Sales Div., National Lead Co.	119
Beardsley & Piper Co.	125
Black, Sivalls & Bryson, Inc.	7
Carborundum Co., The	14-15
Carpenter Bros., Inc.	130
Cleveland Flux Co.	12-13
Cleveland Quarries Co.	123
Crucible Manufacturers' Ass'n.	118
DeBardeleben Coal Corp.	130
Delta Oil Products Co.	24
Demmler, Wm., & Bros.	107
Dietert, Harry W., Co.	128
DoALL Co.	4
Dougherty Lumber Co.	133
Eastern Clay Products, Inc.	10
Electro Metallurgical Div., Union Carbide & Carbon Corp.	22
Fanner Mfg. Co.	8-9
Federal Foundry Supply Co.	1
Federated Metals Div., American Smelting & Refining Co.	28
Foundry Equipment Co.	16
Giffels & Vallet	113
Globe Steel Abrasive Co.	29
Harris, Benj., & Co.	2
Hercules Powder Co.	23
Industrial Equipment Co.	129
International Nickel Co.	26
Jackson Iron & Steel Co.	132
Kalamazoo Stove & Furnace Co.	129
Kirk & Blum Mfg. Co.	109
Korn, Wm., Inc.	128
Kramer, H., & Co.	134
Krause, Chas. A., Milling Co.	19
Lindberg Engineering Co., Laboratory Div.	27
Master Pattern Co.	31
National Carbon Div., Union Carbide & Carbon Corp.	17
National Engineering Co.	32
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc.	127
Oliver Machinery Co.	132
Paddock Tool Co.	131
Pangborn Corp.	11
Penola Inc.	5
Pittsburgh Lectromelt Furnace Corp.	Inside Front Cover
Reece Wooden Sole Shoe Co.	132
Robinson Clay Products Co.	126
Schneible, Claude B., Co.	114
Scientific Cast Products Corp.	128
Smith, Werner G., Co.	Inside Back Cover
Standard Horse Nail Corp.	131
Tennessee Products & Chemical Corp.	6
Tincher Products Co.	122
Union Carbide & Carbon Corp., Electro Metallurgical Div.	22
National Carbon Div.	17
U. S. Graphite Co.	20-21
Velsicol Corp.	30
Wheland Co., The	133
Whiting Corp.	Back Cover
Wiley, John & Sons, Inc.	131

A.F.S. Publications

Alloy Cast Irons Handbook	121
Development of the Metal Castings Industry	18
Foundry Core Practice	115
Foundry Sand Testing Handbook	111
Non-Ferrous Melting Practice	131
Recommended Practices for Non-Ferrous Alloys	130

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Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Kwik-Mix Co., c/o Koehring Co., 3026 W. Concordia, Milwaukee.
Link-Belt Co., 300 W. Pershing Rd., Chicago
Mathews Conveyors Co., Ellwood City, Pa.
Modern Equipment Co., 360 S. Spring St., Port Washington, Wis.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Newaygo Engineering Co., Newaygo, Mich.
Ready-Power Co., 3826 Grand River Ave., Detroit.
Robins Conveyors Div., Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.
Standard Conveyor Co., 315 N. W. Second St., North St. Paul 9, Minn.
Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.
Syntron Co., 545 Lexington, Homer City, Pa.
Towmotor Corp., 1226 E. 152nd St., Cleveland.
Union Steel Products Co., Albion, Mich.
Whiting Corp., Harvey, Ill.

Core and Mold Washes

Borden Co., Chemical Div., 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
Foundry Services, Inc., 280 Madison Ave., New York 16.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Hougland & Hardy—Hardy Sand Co., 507 S. E. 2nd St., Evansville, Ind.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
S. Obermayer Co., 2563 West 18th Street, Chicago 8.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 North Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Pa.
Whitehead Bros. Co., 324 W. 23rd St., New York 11.

Core Binders, Oils and Compounds

American Cyanamid Co., Plastics Dept., 30 Rockefeller Plaza, New York 20.
Bakelite Div., Union Carbide & Carbon Corp., 300 Madison Ave., New York 17.
Black Products Co., 13513 Calumet Ave., Chicago.
Borden Co., Chemical Div., 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Corn Products Sales Co., 17 Battery Place, New York 4.
Dayton Oil Co., 1201 E. Monument Ave., Dayton, Ohio.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.

Foundry Service Co., 2321-29—29th Ave. N., Birmingham, Ala.
Hercules Powder Co., 912 Market St., Wilmington, Del.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33.
Chas. A. Krause Milling Co., Milwaukee.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
Monsanto Chemical Co., St. Louis.
S. Obermayer Co., 2563 West 18th Street, Chicago 8.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Philadelphia.
Penola Inc., 3780 Penobscot Bldg., Detroit 26.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Werner G. Smith Co., 2191 West 110th Street, Cleveland 2.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 North Summit St., Akron, Ohio.
Swan-Finch Oil Corp., RCA Bldg., West, New York 20.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
United Oil Mfg. Co., 1429-31 Walnut, Erie, Pa.
Velsicol Corp., 330 E. Grand Ave., Chicago.

Core Blowers and Supplies

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Wm. Demmler & Bros., Kewanee, Ill.
Eastern Clay Products, Inc., Jackson, Ohio.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Foundry Service Co., 2321-29—29th Ave. N., Birmingham, Ala.
Harrison Machine Co., 2725 Station Rd., Box 67, Wesleyville, Pa.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
The Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
Redford Iron & Equipment Co., 20733 Glendale, Detroit 23.
SPO Inc., 7500 Grand Division Ave., Cleveland 25.

Core Grinders

Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
SPO Inc., 7500 Grand Division Ave., Cleveland 25.

Core Knockout Equipment

Cleco Div. of Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13.
Dayton Pneumatic Tool Co., 8-10 Norwood Ave., Dayton, Ohio.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Pangborn Corp., Hagerstown, Md.

Core Making Machines

British Moulding Machine Co. Ltd., Weston Works, Faversham, Kent, England.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
SPO Inc., 7500 Grand Division Ave., Cleveland 25.
Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.
Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35.

Core Ovens

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Girdler Corp., Thermex Div., 224 E. Broadway, Louisville 1, Ky.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
J. O. Ross Engineering Corp., 350 Madison Ave., New York 17.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Core Paste

Black Products Co., 13513 Calumet Ave., Chicago.
Borden Co., Chemical Division, 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Eastern Clay Products, Inc., Jackson, Ohio.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Foundry Services, Inc., 280 Madison Ave., New York 16.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
S. Obermayer Co., 2563 W. 18th St., Chicago 8.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
Whitehead Brothers Co., 324 W. 23rd Street, New York 11.

Core Plates

Black, Sivalls & Bryson, Inc., Power & Light Bldg., Kansas City, Mo.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Industrial Fabricating, Inc., 817 Hall, Eaton Rapids, Mich.
K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14.

Core Racks

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Industrial Fabricating, Inc., 817 Hall, Eaton Rapids, Mich.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.

Core Rod Straighteners and Shearing Machinery

American Wheelabrator & Equipment Corp., 630 S. Byrkit St., Mishawaka, Ind.
Economy Tool & Machine Co., 1732 Glade St., Muskegon, Mich.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.

Core Sand Reclamation Equipment

Frank G. Hough Co., Libertyville, Ill.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Nichols Engineering & Research Corp., 70 Pine St., New York 5.

Core Vents

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
The PMS Co., 1071 Power Ave., Cleveland 14.
United Compound Co., Inc., 328 S. Park Ave., Buffalo 4.

Core Washes

Asbury Graphite Mills, Inc., Asbury, N. J.
Black Products Co., 13513 Calumet Ave., Chicago.
Borden Co., Chemical Div., 350 Madison Ave., New York 17.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Foundry Services, Inc., 280 Madison Ave., New York 16.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Lava Crucible Co. of Pittsburgh, 627 Wabash Bldg., Pittsburgh.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
Ottawa Silica Co., Box 437, Ottawa, Ill.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.

Couplings • Flexible

Chain Belt Co., 1725 W. Bruce St., Milwaukee 4.

Cranes • Overhead and Tractor

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
American Air Filter Co., Inc., 104 Central Ave., Louisville 8.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Crucibles

American Crucible Co., Washington Ave., North Haven, Conn.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Jos. Dixon Crucible Co., Jersey City 3.
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo, N. Y.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.
Vesuvius Crucible Co., P. O. Box 8275, Swissvale, Pittsburgh 18.

Cupolas

Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Cupola Blowers

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.
Spencer Turbine Co., 486 New Park Ave., Hartford 6, Conn.

Cupola Chargers

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Frank G. Hough Co., Sunnyside Ave., Libertyville, Ill.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., Harvey, Ill.

Cupola Control Equipment

Foxboro Co., Neponset Ave., Foxboro, Mass.

Cupola Lighters

Whiting Corp., Harvey, Ill.

Cutoff Machines

Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35.

Die Casting Machines

DCMT Sales Corp., 164 Duane St., New York 13.

Dust Collecting Equipment • Dry

Aerodyne Development Corp., 2424 Euclid Ave., Cleveland 15.
Alloy Metal Abrasive Co., 311 West Huron Street, Ann Arbor, Mich.
American Air Filter Co., Inc., 104 Central Ave., Louisville 8.
American Wheelabrator & Equipment Corp., 630 South Byrkit St., Mishawaka, Ind.
Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, Inc., 308 Piquette, Detroit 2.

Dust Collecting Equipment • Wet

Aerodyne Development Corp., 2424 Euclid Ave., Cleveland 15.
American Air Filter Co., Inc., 104 Central Ave., Louisville 8.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
Schmieg Industries, Inc., 308 Piquette, Detroit 2.
Claude B. Schneible Co., 2827-25th St., Detroit.
Whiting Corp., Harvey, Ill.

Electrodes

Great Lakes Carbon Corp., Niagara Falls, N. Y.
International Graphite & Electrode Corp., St. Marys, Pa.

Exothermic Materials (Pipe Eliminators)

Alpha-Lux Co., Inc., 155 John St., New York.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Exomet, Inc., Maple Ave., Conneaut, Ohio.
Exothermic Alloys Sales & Service, Inc., 301 E. 138th St., Chicago 27.
Foundry Services Inc., 280 Madison Ave., New York 16.
Lava Crucible Co. of Pittsburgh, 627 Wabash Bldg., Pittsburgh.
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17, N. Y.

Facings • Foundry

Asbury Graphite Mills, Inc., Asbury, N. J.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Minco Products Corp., Box 367, Saginaw, Mich.
S. Obermayer Co., 2563 West 18th St., Chicago 8.
Penn-Rillton Co., 324 W. 23rd, New York 11.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Frederic B. Stevens, Inc., 1800-18th St., Detroit 16.
Stoller Chemical Co., 31 North Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
United States Graphite Co., 1621 Holland Ave., Saginaw, Mich.
Whitehead Brothers Co., 324 W. 23rd St., New York 11.

Ferro-Alloys

Climax Molybdenum Co., 500 Fifth Ave., New York.
Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17.
Exothermic Alloys Sales & Service, Inc., 301 E. 138th St., Chicago 27.
Globe Iron Co., Jackson, Ohio.
Jackson Iron & Steel Co., Jackson, Ohio.
Tennessee Products & Chemical Corp., American Nat'l Bank Bldg., Nashville.
Vanadium Corp. of America, 420 Lexington Ave., New York 17.

Fire Brick

Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Carborundum Co., Niagara Falls, N. Y.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
Pyro Refractories Co., Oak Hill, Ohio.
Robinson Clay Products Co., Box 1070, 65 W. State St., Akron 8, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Flask Lumber

Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
White Pine Lumber Co., 2460 S. Damen Ave., Chicago 8.

Flask Trimmings and Jackets

Adams Co., 100 East 4th St., Dubuque, Iowa.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Universal Engineering Co., Frankenmuth, Mich.

Flasks • Aluminum

Adams Co., 100 East 4th St., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
Hines Flask Co., 3431 W. 140th St., Cleveland 11.
Peerless Mineral Products Co., Whitney Block, Main St., Conneaut, Ohio.

Flasks • Magnesium

Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
Peerless Mineral Products Co., Whitney Block, Main St., Conneaut, Ohio.

Flasks • Steel

Black, Sivalls & Bryson, Inc., Power & Light Bldg., Kansas City, Mo.
Abe Cooper-Syracuse Inc., 107 W. Hiawatha Blvd., Syracuse, N. Y.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14.

Flasks • Wood

Adams Co., 100 East 4th St., Dubuque, Iowa.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.

Flexible Shaft Equipment

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.

Fluxes • Cupola

Carborundum Co., Niagara Falls, N. Y.
Cleveland Flux Co., 1026-34 Main Ave., N.W., Cleveland.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati.
Foundry Services Inc., 280 Madison Ave., New York 16.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Solvay Sales Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 746 W. Virginia St., Milwaukee 4.

Fluxes • Ladle

Cleveland Flux Co., 1026-34 Main Ave., N.W., Cleveland.
Foundry Services Inc., 280 Madison Ave., New York 16.
Solvay Sales Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.

Fluxes • Non-Ferrous

Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
Foundry Services Inc., 280 Madison Ave., New York 16.
Wm. F. Jobbins, Inc., Box 230, Aurora, Ill.
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17, N. Y.
Rossborough Supply Co., Box 2212—Brooklyn Station, Cleveland.

Fluxes • Welding

Linde Air Products Co., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.

Foundry Supplies • General

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Black Products Co., 13513 Calumet Ave., Chicago.
Buckeye Products Co., 7020 Vine St., Cincinnati 16.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Rd., West Bromwich, England.
Foundry Service Co., 2321-2329—29th Ave. N., Birmingham, Ala.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Industrial Fabricating, Inc., 817 Hall, Eaton Rapids, Mich.
Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12.
J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22.
North American Smelting Co., Marine Terminal, Wilmington 83, Dela.
S. Obermayer Co., 2563 W. 18th St., Chicago 8.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
Frederic B. Stevens, Inc., 1800—18th St., Detroit 16.

Furnace Linings

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Alpha-Lux Co., Inc., 155 John St., New York 1.
American Crucible Co., Washington Ave., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Joseph Dixon Crucible Co., 167 Wayne St., Jersey City 6, N. J.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Pyro Refractories Co., Oak Hill, Ohio.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.

Furnaces • Aluminum and Magnesium Melting

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Engineering Corp., Lalor and Hancock Sts., Trenton, N. J.
Ajax Metal Co., Frankford Ave. & Richmond St., Philadelphia.
Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Electric

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Engineering Corp., Lalor and Hancock Sts., Trenton, N. J.
Ajax Metal Co., 46 Richmond St., Philadelphia 23.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Detroit Electric Furnace Div., Kuhlman Electric Co., 1000—26th St., Bay City, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12.
Pittsburgh Lectromelt Furnace Corp., Box 1257, Foot of 32nd St., Pittsburgh.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Furnaces • Gas and Oil

Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Heat Treating

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Metal Co., 46 Richmond St., Philadelphia 23.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Goggles

Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh.
Pangborn Corp., Hagerstown, Md.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

Graphite Products

American Crucible Co., North Haven, Conn.
Asbury Graphite Mills, Inc., Asbury, N. J.
Joseph Dixon Crucible Co., 167 Wayne St., Jersey City 6, N. J.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5.
International Graphite & Electrode Corp., St. Marys, Pa.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35.
Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Thiem Products, Inc., 9800 W. Rogers St., Box 2612, Milwaukee 14.
United States Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.
Vesuvius Crucible Co., Box 8275, Swissvale, Pittsburgh 18.

Grinders • Flexible Shaft

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.
PMS Co., 1071 Power Ave., Cleveland 14.

Grinders • Portable, Bench, and Stand

Cleco Div., Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Fox Grinders, Inc., 622 Oliver Bldg., Pittsburgh 22.
Rotor Tool Co., 17325 Euclid Ave., Cleveland.

Grinders • Swing Frame

DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Fox Grinders Inc., 622 Oliver Bldg., Pittsburgh.

Grinding Wheels

Bay State Abrasive Products Co., Union St., Westboro, Mass.
Carborundum Company, Niagara Falls, N. Y.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2.
Macklin Co., 2914 Wildwood Road, Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7.
Precision Grinding Wheel Co., Inc., 8301 Torresdale Ave., Philadelphia 36.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37.
United States Rubber Co., 1230 Avenue of the Americas, New York 20.

Hammers • Pneumatic

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dallett Company, Mascher at Lippincott St., Philadelphia.
Dayton Pneumatic Tool Co., P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.

Heaters • Ladle and Mold

Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Helmets • Blasting

Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh.
Pangborn Corp., Hagerstown, Md.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
United States Rubber Co., 1230 Avenue of the Americas, New York

Helmets • Welding

Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

Hoists • Chain or Electric

Cleveland Crane & Engineering Co., Cleveland Tramrail Div., Wickliffe, Ohio.

Hoists • Overhead

Cleveland Crane & Engineering Co., Cleveland Tramrail Div., Wickliffe, Ohio.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Hose • Oxygen and Acetylene

Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.
Manhattan Rubber Div., Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
United States Rubber Co., 1230 Avenue of the Americas, New York 20.

Hose • Pneumatic

Cleco Div., Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Dallett Co., Mascher at Lippincott St., Philadelphia 33.
Dayton Pneumatic Tool Co., 8-10 Norwood Ave., Dayton, Ohio.
Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.
Manhattan Rubber Div., Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
Master Pneumatic Tool Co., Inc., Peniman Road, Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.
United States Rubber Co., 1230 Avenue of the Americas, New York 20.

Ingots • Aluminum Alloy

Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
Federated Metals Division, American Smelting & Refining Co., Inc., 120 Broadway, New York 5.
Wm. F. Jobbins, Inc., Box 230, Aurora, Ill.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago.
Michigan Smelting & Refining Div., Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit 26.
Niagara Falls Smelting & Refining Division, Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17.
North American Smelting Co., Marine Terminal, Wilmington 83, Del.

Ingots • Non-Ferrous

Ajax Metal Co., 46 Richmond St., Philadelphia 23.
Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
L. A. Cohn & Bros., Inc., 5429 Roosevelt Rd., Chicago 50.
Federated Metals Division, American Smelting & Refining Co., Inc., 120 Broadway, New York 5.
Benj. Harris & Co., 11th & State Sts., Chicago Heights, Ill.
Wm. J. Jobbins, Inc., Box 230, Aurora, Ill.
H. Kramer & Co., 1345 W. 21st St., Chicago.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago.
Michigan Smelting & Refining Div., Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit 26.
Nassau Smelting & Refining Co., Inc., 1 Nassau Place, Tottenville, Staten Island, N. Y.
Niagara Falls Smelting & Refining Division, Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17.
North American Smelting Co., Marine Terminal, Wilmington 83, Del.
I. Schumann & Co., 4391 Bradley Rd., Cleveland.
Silverstein & Pinsof, Inc., 1720 Elston, Chicago.

Inspection and X-Ray

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14.
Magnaflux Corp., 5900 Northwest Highway, Chicago 31.

Insulation

Campbell-Hausfeld Co., 402 Moore St., Harrison, Ohio.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22.
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.

Laboratory and Scientific Equipment

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Great Western Mfg. Co., 208-220 Choctaw St., Leavenworth, Kan.
K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Laboratory Equipment Corp., St. Joseph, Mich.
Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
Wheelco Instruments Co., 847 W. Harrison St., Chicago 7.

Laboratory Service

Accurate Metal Laboratories, 2454 W. 38th St., Chicago 32.
Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Casadonte Research Laboratories, 2410 Lake Ave., North Muskegon, Mich.
Chicago Spectro Service Lab., Inc., 2454 W. 38th St., Chicago 32.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Charles C. Kawin Co., 431 S. Dearborn St., Chicago 5.
Andrew King, 521 Broad Acres Rd., Narberth, Pa.
Earl E. Woodliff, 14611 Fenkel, Detroit 27.

Ladle Linings • Fitted

American Crucible Co., North Haven, Conn.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
Joseph Dixon Crucible Co., 167 Wayne St., Jersey City 6, N. J.
Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22.
Pyro Refractories Co., Oak Hill, Ohio.

Ladle Linings • Plastic

Alpha-Lux Co., Inc., 155 John St., New York.
American Crucible Co., North Haven, Conn.
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
Pyro Refractories Co., Oak Hill, Ohio.
The Robinson Clay Products Co., Box 1070, 65 W. State St., Akron 8, Ohio.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.

Ladles

Industrial Equipment Co., 115 N. Ohio, Minster, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Magnetic Separators

Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Newaygo Engineering Co., Newaygo, Mich.

Magnets

Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland 4.

Matchplates

Accurate Match Plate Co., 1847-51 W. Carroll Ave., Chicago 12.
Precision Pattern Works, 5269 W. Grand Ave., Chicago 39.
Pressure Match Plate Co., Inc., 1013-15 N. Front St., Philadelphia 23.
Reliable Castings Corp., 3530 Spring Grove Ave., Cincinnati 23.
Scientific Cast Products Corp., 1390 E. 40th St., Cleveland.

Metallizing Equipment

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Metallizing Company of America, 3520 W. Carroll Ave., Chicago 24.

Metallographic Equipment

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.

Metal Marking Crayons

Wm. Korn, Inc., 260 West St., New York 13.

Meters • Air Velocity

Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago.

Milling Cutters and Burrs

Severance Tool Ind., Inc., Saginaw, Mich.

Mold Blowers

International Molding Machine Co., 1201 N. 12th Ave., La Grange Park, Ill.

Mold Conveyors

C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Chain Belt Co., 1725 W. Bruce Street, Milwaukee 4.
Link-Belt Company, 300 W. Pershing Road, Chicago 1.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Newaygo Engineering Co., Newaygo, Mich.

Mold Ovens and Dryers

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.

Molding Machines

Adams Co., 100 East 4th St., Dubuque, Iowa.
Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
British Moulding Machine Co. Ltd., Weston Works, Faversham, Kent, England.
Centrifugal Casting Machine Co., Box 947, Tulsa 1, Okla.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Crescent Machine Div., Rockwell Mfg. Co., Leetonia, Ohio.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Johnston & Jennings Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Wm. H. Nicholls Co., Inc., 126 St. & 91st Ave., Richmond Hill, N. Y.
Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
SPO Incorporated, 7500 Grand Division Ave., Cleveland.
Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.
Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35.

Monorail and Tramrail Systems

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop, Harvey, Ill.

Oils • Lubricating

Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33.
Penola, Inc., 221 N. LaSalle St., Chicago 1.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Swan Finch Oil Corp., RCA Bldg. West, New York 20.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Pa.

Ovens • Annealing and Heat Treating

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Salem Engineering Co., 714 S. Broadway, Salem, Ohio.
Whiting Corp., 15628 Lathrop, Harvey, Ill.

Oxygen

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Linde Air Products Co., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17.

Patterns

City Pattern Foundry & Machine Co., 1161 Harper at Rivard, Detroit.
Precision Pattern Works, 5269 W. Grand Ave., Chicago.
Reliable Castings Corp., 3530 Spring Grove Ave., Cincinnati 23.

Pattern Coatings and Finishes

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
PMS Co., 1071 Power Ave., Cleveland 14.

Pattern Compound

PMS Co., 1071 Power Ave., Cleveland 14.
Tamms Silica Co., 228 No. La Salle St., Chicago.

Pattern Lumber

Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
White Pine Lumber Co., 2460 S. Damen Ave., Chicago 8.

Pattern Plates

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7.
Dougherty Lumber Co., 4300 E. 68th, Cleveland 5.
Foundry Service Co., 2321-2329—29th Ave. N., Birmingham, Ala.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
PMS Co., 1071 Power Ave., Cleveland 14.
Scientific Cast Products Corp., 1388-1392 E. 40th St., Cleveland 3.

Pattern Shop Equipment and Supplies

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7.
Crescent Machine Div., Rockwell Mfg. Co., Leetonia, Ohio.
Eastern Clay Products, Inc., Jackson, Ohio.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Kindt-Collins Co., 12641 Elmwood Ave., Cleveland.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
PMS Co., 1071 Power Ave., Cleveland 14.

Photographic Materials • Metallography

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.
Eastman Kodak Co., 343 State St., Rochester, N. Y.

Pig Iron

Globe Iron Co., Jackson, Ohio.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Jackson Iron & Steel Co., Jackson, Ohio.
Tennessee Products & Chemical Corporation, American National Bank Bldg., Nashville.

Pig Iron • Alloy

Globe Iron Co., Jackson, Ohio.
Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro-Metals Co., 429 South 4th St., Keokuk, Iowa.

Plaster

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo, N. Y.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Tamms Industries Co., 228 N. La Salle St., Chicago.
United States Gypsum Co., 300 W. Adams St., Chicago.

Pneumatic Tools

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dallett Co., Mascher at Lippincott St., Philadelphia.
Master Pneumatic Tool Co., Inc., Orwell, O.
Schramm Inc., West Chester, Pa.

Porosity Equipment and Sealers

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Metallizing Company of America, 3520 W. Carroll Ave., Chicago 24.
Tincher Products Co., 800 Borden Ave., Sycamore, Ill.
Tousey Varnish Co., 520 W. 25th St., Chicago 16.

Portable Tools • Air

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dallett Co., Mascher at Lippincott St., Philadelphia 33.
Dayton Pneumatic Tool Co., 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.

Portable Tools • Electric

K & F Metal Spray Industries, 13928 E. Jefferson Ave., Detroit 15.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.

Power Units and Transmissions

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
Ready-Power Co., 3826 Grand River Ave., Detroit 8.

Pyrometers • Immersion

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foxboro Co., Neponset Ave., Foxboro, Mass.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.
Tamms Industries Co., 228 N. La Salle St., Chicago.

Pyrometers • Optical

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.

Rammers • Pneumatic

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Tex.
Dayton Pneumatic Tool Co., P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12.
Schramm Inc., West Chester, Pa.

Refractories

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
American Crucible Co., North Haven, Conn.
Carborundum Company, Niagara Falls, N. Y.
Carpenter Bros., Inc., 606 W. Wisconsin Ave., Milwaukee 3.
Cleveland Quarries Co., 1740 E. Twelfth St., Cleveland 14.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Jos. Dixon Crucible Co., Jersey City 3.
Eastern Clay Products, Inc., Jackson, Ohio
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22.
Hill & Griffith Co., Cincinnati-Birmingham-Chicago.
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.

Laboratory Equipment Corp., St. Joseph, Mich.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22.
Mexico Refractories Co., Cole & Love Sts., Mexico, Mo.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Philadelphia.
Pyro Refractories Co., Oak Hill, Ohio.
Quigley Company, Inc., 527 Fifth Ave., New York 17.
Robinson Clay Products Co., Box 1070, 65 W. State St., Akron 8, Ohio.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35.
Frederic B. Stevens, Inc., 1800-18th St., Detroit 16.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
U. S. Graphite Co., Div. of Wickes Corp., 1621 Holland Ave., Saginaw, Mich.
Vesuvius Crucible Co., Box 8275, Swissvale, Pittsburgh 18.

Respirators

Martindale Electric Co., 1347 Hird Ave., Cleveland 7.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8.
Pangborn Corp., Hagerstown, Md.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

Riddles and Screens

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Great Western Mfg. Co., 208-220 Choctaw St., Leavenworth, Kan.
Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.

Safety Clothing and Equipment

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8.
Pangborn Corp., Hagerstown, Md.
Reece Wooden Sole Shoe Co., 2207-11th St., Columbus, Neb.
Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.
Safety First Shoe Co., Water St., Holliston, Mass.

Sand • Blast

Carborundum Co., Niagara Falls, N. Y.
Carpenter Bros., Inc., 606 W. Wisconsin Ave., Milwaukee 2.
Delhi Foundry Sand Co., 6326 River Rd., Cincinnati 33.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47.
Industrial Minerals Co., Kirn Bldg., Lancaster, Ohio.
Manley Sand Co., Rockton, Ill.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.
Pangborn Corp., Hagerstown, Md.
Peerless Mineral Products Co., Whitney Block, Main St., Conneaut, Ohio.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh 1.
Steel Shot and Grit, Inc., Boston, Mass.
Tamms Industries, Inc., 228 N. La Salle St., Chicago 1.
Whitehead Brothers Co., 324 W. 23rd St., New York 11.

Sand • Core and Mold

Ayers Mineral Co., Masonic Temple, Zanesville, Ohio.
Carpenter Brothers, Inc., 606 West Wisconsin Ave., Milwaukee 3.
Central Silica Co., Zanesville, Ohio.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Hoffman Foundry Supply Co., 1193 Main Ave., Cleveland 13.
Hougland & Hardy—Hardy Sand Co., 507 S. E. 2nd St., Evansville, Ind.
Industrial Minerals Co., Kirn Bldg., Lancaster, Ohio.
Manley Sand Co., Rockton, Ill.
Millwood Sand Co., Masonic Temple, Zanesville, Ohio.
Minco Products Corp., Box 367, Saginaw, Mich.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Sand Products Corp., 699 Perry Payne Bldg., Cleveland 13.
Stoller Chemical Co., 31 N. Summit St., Akron, Ohio.
Taggart Brimfield Co., 110 Bellevue Ave., Hammonton, N. J.
Titanium Alloy Mfg. Div., National Lead Co., 111 Broadway, New York 6.
Whitehead Brothers Co., 324 W. 23rd St., New York 11.
Zanesville Sand Co., Zanesville, Ohio.

Sand Blast Equipment

Alloy Metal Abrasive Co., 311 West Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Corp., 630 South Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47.
Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Pangborn Corporation, Hagerstown, Md.

Sand Control and Testing Equipment

Alpha-Lux Co., Inc., 155 John St., New York.
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago.
Great Western Mfg. Co., 208-220 Choctaw, Leavenworth, Kan.
Laboratory Equipment Corp., St. Joseph, Mich.

Sand Handling and Conditioning Equipment

Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Chain Belt Co., 1725 West Bruce St., Milwaukee 4.
Hewitt-Robins, Inc., 370 Lexington Ave., New York 17.
Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
Moulders' Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Newaygo Engineering Co., Newaygo, Mich.
Nichols Engineering & Research Corp., 70 Pine St., New York 5.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

Sand Mixers

American Wheelabrator & Equipment Corp., 630 S. Byrkit St., Mishawaka, Ind.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Blystone Div., Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6.
Clearfield Machine Co., Box 249, Clearfield, Pa.
Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Moulders' Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.

Sand Reclamation Equipment

C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
National Engineering Co., 549 W. Washington Blvd., Chicago 6.
Nichols Engineering & Research Corp., 70 Pine St., New York 5.
Simplicity Engineering Co., Durand, Mich.

Saws • Metal Cutting

Carborundum Co., Niagara Falls, N. Y.
Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
PMS Co., 1071 Power Ave., Cleveland 14.

Saws • Woodworking

Delta - Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
PMS Co., 1071 Power Ave., Cleveland 14.

Scales

Toledo Scale Co., Telegraph Rd., Toledo 1, Ohio.

Shake-out Machinery

Allis-Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee.
C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5.
Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39.
Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13.
Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago.
Robins Conveyors Div., Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

Shock Absorption Materials

Raybestos-Manhattan, Inc., 61 Willett, Passaic, N. J.

Shot and Grit

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
Carborundum Co., Niagara Falls, N. Y.
Carpenter Brothers, Inc., 606 West Wisconsin Ave., Milwaukee 3.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati 33.
Foundry Service Co., 2321-2329—29th Ave. N., Birmingham, Ala.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26.
Hickman, Williams & Co., 1154 Union Commerce Bldg., Cleveland.
Manley Sand Co., Rockton, Ill.
Pangborn Corp., Hagerstown, Md.
George F. Pettinos, Inc., 1206 Locust St., Philadelphia.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh.
Steel Shot & Grit Co., Inc., 39 Warren Bridge, Boston 14.
Whitehead Bros. Co., 324 W. 23rd St., New York 11.

Spectrographic Equipment

Buehler Ltd., 165 W. Wacker Dr., Chicago 1.

Temperature Control and Recording Devices

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foxboro Co., Neponset Ave., Foxboro, Mass.
Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.

Testing Equipment • Hardness

Andrew King, 521 Broad Acres Rd., Narberth, Pa.

Thermocouples

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4.
Foxboro Co., Neponset Ave., Foxboro, Mass.

Claud S. Gordon Co., 3000 S. Wallace St., Chicago 16.
Illinois Testing Laboratories, Inc., 420 N. La-Salle St., Chicago.
Pyrometer Instrument Co., Inc., Bergenfield, N. J.
Tamms Industries, Inc., 228 N. La Salle St., Chicago 1.

Tumbling Barrels

Macleod Co., 2232-40 Bogen St., Cincinnati 22.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Vacuum Cleaning Equipment

Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7.
Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.
Spencer Turbine Co., 486 New Park Ave., Hartford 6, Conn.
U. S. Hoffman Machinery Corp., 99 Fourth Ave., New York 3.

Ventilating Systems

Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati.
Pangborn Corp., Hagerstown, Md.
H. H. Robertson Co., 2400 Farmers Bank Bldg., Pittsburgh 22.
Schmieg Industries, Inc., 308 Piquette, Detroit 2.
Claude B. Schneible Co., 2827-25th St., Detroit.

Vibrators

Adams Co., Box 268, Dubuque, Iowa.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Drive, Houston, Tex.
Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee.
Dallett Co., Mascher at Lippincott St., Philadelphia.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22.
Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14.
Syntron Co., 545 Lexington, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35.

Welding and Cutting Equipment

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Delta-Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Linde Air Products Co., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.
Metallizing Co. of America, 3520 W. Carroll Ave., Chicago 24.

Welding Rods

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14.
Haynes Stellite Div., Union Carbide & Carbon Corp., Kokomo, Ind.
International Nickel Co., Inc., 67 Wall St., New York 5.
Linde Air Products Co., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.
National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York.

Wheelbarrows

Kwik-Mix Co., c/o Koehring Co., 3026 W. Concordia, Milwaukee 16.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14.

Woodworking Machinery

Crescent Machine Div., Rockwell Mfg. Co., Leetonia, Ohio.
Delta-Power Tool Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
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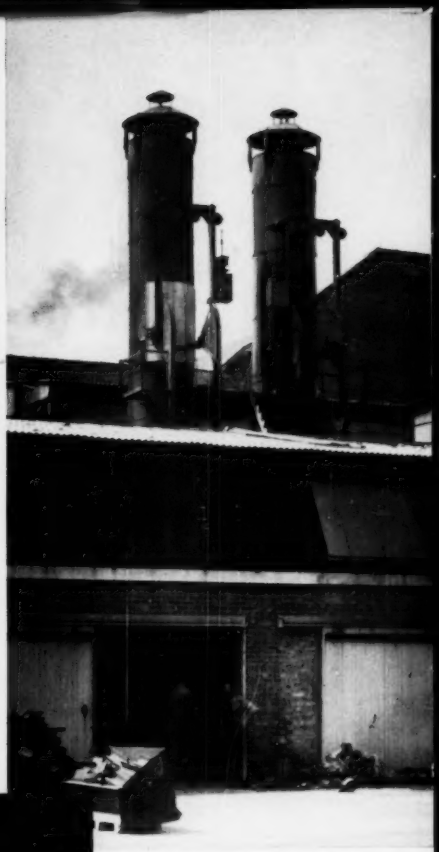

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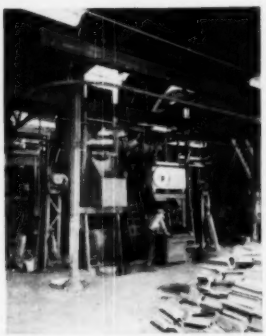

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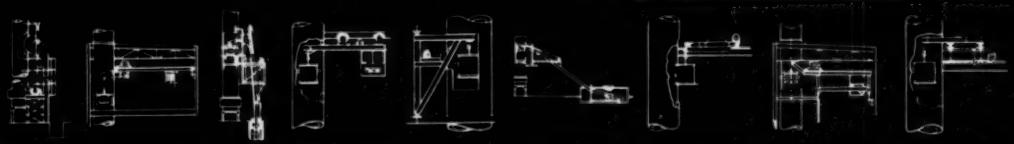

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